Metals Review

April 1959

SCIENCE & TECHNOLOGY

Allen Ray Putnam
Managing Director
American Society for Metals
(See Article, Page 4)

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MEET RAY PUTNAM

. . . . managing director, American Society for Metals

By Clarence H. Lorig, President
American Society for Metals

Allan Ray Putnam has been appointed Managing Director of the American Society for Metals. He comes to A.S.M. from his position as assistant executive secretary of the American Society of Tool Engineers.

Nobody could ever replace Bill Eisenman in the American Society for Metals. No one will ever forget his leadership, his plans for tomorrow, his inspirational enthusiasm for A.S.M. Bill was unique. Much of what he did will never have to be done again. But, while still feeling deep personal loss and recognizing the force that would be missing from A.S.M., your Board of Trustees determined that the Society should continue in a manner that would make Bill Eisenman proud.

As with the greats of the sports world, Bill's title of Secretary has been retired so far as headquarters management is concerned. A Secretary will continue to be elected and to serve as a member of the Board, but he will not be the director of headquarters staff activities. So, your Board set about to find a man to take over active management of the Society. We engaged professional help to locate the man to do the job we knew had to be done. Bill's true worth to the Society has been amply illustrated by the time it has taken us to find this man—Allan Ray Putnam—to step into a newly created position of Managing Director.

Ray knows in what large footsteps he will be walking, but he is able, skilled and genuinely interested in the direction of an educational-scientific society. He will come to us with considerable first-hand experience in the administration of technical societies, and looks on his new duties as a challenge to his ability and experience.

He joins A.S.M. at the beginning of a significant era. Membership is growing and parallel to this growth are programs to better serve the expanding technical field. We are constantly enlarging the scope of our educational and publishing activities. Our staff is growing, both in number and ability, and is about to move into our new headquarters building.

One of the managing director's first activities will be to help the staff settle into its new surroundings. I think it is fortunate that we go into this new phase of A.S.M.'s exciting future with a young and aggressive managing director. He will be at the helm to help, in every way possible, to augment and support both the short and the long-range programs of the A.S.M. as envisaged by your Board.

HIS PROFESSIONAL BACKGROUND

Ray comes to A.S.M. from his position as assistant executive secretary of the American Society of Tool Engineers, where he has been for the past ten years—a time of rapid expansion for A.S.T.E. He was also publisher of A.S.T.E.'s *Tool Engineer*. This experience should prove invaluable to A.S.M.

During three years with the American Electroplaters' Society, Ray acted as business manager of *Plating* and helped to promote the Society's expositions, conventions and public relations programs. Prior to his association with A.E.S. he spent four years as an Army Air Force officer, during which time he attained the rank of captain and a familiarity with military administration, statistics and budgets. Ray graduated from the Wharton School of Finance and Commerce of the University of Pennsylvania in 1942 with a B.S. degree in Economics.

BUT WHO IS RAY PUTNAM?

Any man's experiences are only a part of him. Ray is a truly warm, friendly and understanding person. He and his wife Marion have three happy children, ages 5 to 12. He is active in both professional and civic groups. Long-time associates have found him easy to work with and for. Although he is an administrator and a planner, Ray doesn't hesitate to roll up his sleeves and become a doer. As such, he looks for the direct, rather than the complicated way of doing things.

Ray has been active in the Council of Engineering Society Secretaries and currently serves as president of that group. He was president of the National Association of Exhibit Managers in 1955. He is also a member of the American Society of Association Executives, the American Management Association, the National Industrial Advertisers Association, the American Marketing Association, the American Dialect Society and the Engineering Society of Detroit, all activities of a man who takes his professional growth seriously.

While living in Franklin, Mich., Ray participated actively in community affairs as a trustee of the Royal Oak Congregational Church, a member of the Committee of Management of the YMCA in Birmingham, and a vice-president of the PTA of his local junior high school, activities of a man who recognizes his obligations to the society in which he lives.

But all work and no play leads to a warped personality. Ray's is anything but that. He knows how to play hard and he enjoys both the activity of the sport and the pleasant exhaustion of the relaxation afterward. He likes boating and more specifically sailboating, vacationing in Cape Cod when possible. Ray also has strong family roots in Roanoke, Va. which take him back there frequently.

WHAT OF THE FUTURE?

New programs will develop as Ray becomes acquainted with his new position. We can look forward with assurance to several things: He will be able to direct a program intelligently; he will implement it understandingly, and he'll alter it as conditions warrant. Ray won't hesitate to make decisions—but these decisions will be based on what's best for the American Society for Metals and its members.

I am sure all members of A.S.M. who will be working with Ray will soon feel as I do—that our Society is in good hands.—**C. H. Lorig.**

Speaks on Importance Of Ceramics to the Metallurgist at Ontario

Speaker: J. E. Burke

General Electric Research Laboratory

J. E. Burke, manager, ceramic studies, Research Laboratory, General Electric Co., spoke at a meeting of the **Ontario Chapter** on the subject "A Metallurgist Looks at Ceramics".

Dr. Burke pointed out several reasons why a metallurgist should look at ceramics. The metallurgist has problems in finding improved metals to meet the needs of newer or more severe applications and problems in better understanding the reasons why metals behave as they do. Metallurgists should look at ceramics with greater care because in ceramics they will find at least partial answers to both these problems. Ceramics are intrinsically better suited than metals to many uses, for example, at high temperatures or under corrosive conditions. Some of their properties cannot be matched by metals—ceramics are electrical insulators and transparent. Finally, because ceramics are solids, understanding their behavior provides a greatly broadened base for understanding the behavior of all solids (for example, during chemical reactions or during fracture or plastic flow). The metallurgist may both learn from and make contributions to ceramics technology.

The ceramic industry is a large one (approximately $5,000,000,000 a year in the United States). Of this amount glass products make up the largest part, but clay products, such as tile and sewer pipe brick, cement and plaster, are nearly equal in importance. The most active areas in ceramic science and development at present are those associated with special-purpose materials, ceramics which may be used at very high temperatures or which have great corrosion resistance, or materials which may be used in nuclear reactors or have unusual magnetic or electrical properties. In such materials, it is important that properties be controlled with great precision.

To control properties, the *structure* of the material must be controlled carefully, thus, one of the great areas of research at the present time is in the control of the structures of ceramic materials to produce the desired properties. One of the most important of the structure controlling reactions is sintering since almost all ceramic materials are made by the sintering together of powder particles.

Dr. Burke next presented a short description of the recent advances made in understanding the mechanism of the sintering process and showed some of the advantages of using metallographic techniques to study the process in ceramics.

Ceramics are usually considered to be highly inert materials, and this is true in strongly oxidizing atmospheres, but under other atmospheric conditions many reactions may occur which produce striking changes in the properties of ceramic materials. For example, slight chemical reduction may cause a great increase in electrical conductivity or a great increase in evaporation rate. Atmospheric attack by moisture may produce slight pitting or corrosion on the surface which will cause tremendous decrease in mechanical strength of ceramic materials.

With respect to mechanical properties, ceramics may be divided into three classes: (1) A group which shows no plastic deformation under any conditions of temperature or stress (crystalline quartz); (2) Groups which do display some plastic deformation at elevated temperatures but show no ability to flow at ordinary temperatures. (A typical noncrystalline example of this is, glass which flows like a liquid at high temperatures but does not flow at all at low temperatures. Since most conventional ceramics are glass bonded crystals they show no trace of ductility at room temperature, similar to the behavior of aluminum oxide (sapphire) single crystals which slip like a metal at very high temperatures but are completely brittle at room temperature). (3) A group which will undergo some limited plastic deformation at room temperature. Examples of this are sodium chloride and most ionic crystals, magnesium oxide, etc. As yet, ceramic scientists do not have sufficient information to determine whether it will ever be possible to utilize the slight ability of these ionic crystals to undergo plastic deformation to engineering advantage.—**Reported by B. M. Hamilton for Ontario.**

Utah Enjoys Annual Social Event

The Theme "Out of This World", Effectively Carried Out With Table Decorations of Rockets and Satellites, Keynoted the Annual Christmas Party Held by Utah Chapter, at Which 230 Members and Guests Enjoyed Themselves. Shown, seated: Mrs. and Mr. J. F. May, chairman, and Mrs. K. Bentley. Second row, from left: Mr. and Mrs. James Scanlon, Mrs. H. Bunnell, Mrs. E. W. Harding, Mrs. R. O. Kron, and Mrs. Ann Warner. In the third row, from left: M. V. Warner, Mrs. and Mr. R. Blake, K. Bentley and R. O. Kron. (Reported by L. D. Scott for Utah Chapter)

Explosive Forming Is San Fernando Valley Subject

Speaker: R. A. Cooley

Propellax Chemical Corp.

Over 80 members of the **San Fernando Valley Chapter** heard a preview to the Western Metals Congress educational session on explosive forming in a talk on "Explosive Forming of Metals" by R. A. Cooley, Propellax Chemical Corp.

Dr. Cooley's talk covered the field of explosive forming from the selection and design of explosive charges, through the development and application of tooling and pressure transmission media, to the actual forming of metal parts.

Throughout the entire talk, Dr. Cooley presented appropriate slides depicting various phases of explosive forming and including numerous actual production applications. The highlight of the talk was a "live" demonstration of explosive forming which was performed at the podium using a portable forming die and charge container and actually forming a part by explosive means before the assembled audience.—**Reported by J. W. Morris for San Fernando Valley**

Western Show Sets New Sales-Attendance Records

New records in sales from the floor were set at A.S.M.'s 11th Western Metals Exposition just completed in Los Angeles. One concern wrote a $750,000 order and another an order for $200,000. Practically all reported increased sales over previous shows and more prospects for business than ever before.

Exhibitors were enthusiastic with show attendance that exceeded 60,000 visitors for the five-day run. So successful was the show that A.S.M. officials have set Mar. 20-24, 1961, as return dates for the next exposition in Los Angeles. Exhibitors sought to book space for the next show, many of them seeking the same booth areas they occupied this year. Reservations, however, will not be made until the summer of 1960, when floor plans will be available from A.S.M. headquarters.

The National Metal Congress sessions held in the Ambassador Hotel by the American Society for Metals, the American Welding Society, the Society for Nondestructive Testing and the Southern California Chapter, Metals Branch, American Institute for Mining, Metallurgical and Petroleum Engineers, were noteworthy for the technical material presented in their programs. Total attendance at the technical sessions ran to more than 6000 interested listeners.

Success of the sessions devoted to the new explosive forming process presented by A.S.M. exceeded all expectations. General sessions directed by the Los Angeles Chapter A.S.M., attracted large audiences due to the high educational value of the papers, discussions and panels.

The 41st National Metal Exposition and Congress will be held in Chicago from Nov. 2-6, this year. Orders are now being taken for space in the Chicago show.

A.S.M.'s 2nd Southwest Metal Congress and Exposition is scheduled for Dallas, Apr. 25-29, 1960.

The Scenes at Right Show Just a Few of the Activities That Kept Visitors to the Western Metal Congress and Exposition Busy During the Week of the Show. At top, in the exhibition hall, exceptional numbers of visitors made exhibitors happy; center, during one of the technical sessions; and bottom, part of the audience attending a technical session. It all added up to another fine Western Metal Congress and Exposition

Southern Metals Conference . . .

Augusta, Ga., May 4-6, 1959

The Savannah River Chapter will be host to the Southern Metals Conference for 1959 in Augusta, Ga., on May 4, 5 and 6. Theme of the Conference will be "Metallurgical Frontiers". The Southern Metals Conference, sponsored annually by one of the A.S.M. chapters in the Southeast, is dedicated to promoting a better understanding of the effects of metallurgy and metalworking on the scientific and industrial life of the region. This year's conference will be the first to be held in the Augusta area.

The program of the Conference will feature the many new advances in understanding and use of metals in recent technology, including a discussion of advanced concepts in solid fuel power reactors by Walter H. Zinn, nuclear reactor designer, and a review of materials research for outer space ventures by D. W. Gates, missile materials scientist from the Army Ordnance Missile Command, Redstone Arsenal, Ala. Among other highlights will be an address by National President Clarence H. Lorig, Battelle Memorial Institute, and a tour of the Atomic Energy Commission's Savannah River Plant, one of the largest U. S. installations devoted to the production of nuclear materials.

The complete technical program is as follows:

Monday, May 4

9:30—"Welcome to 1959 Southern Metals Conference", by W. L. Worth, Chairman

"Research and Development Facilities for the Southeast", by J. R. Kattus, Head, Metallurgy, Southern Research Institute, Birmingham, Ala.

"Coatings for Corrosion Protection", by J. D. Rode, Product Manager, Industrial Maintenance Sales, Finishes Division, E. I. du Pont de Nemours & Co., Wilmington, Del.

2:00—"Practical Design of Extrusion Dies", by C. DeBuigne, Manager, Moczik Tool & Die Works, Detroit, Mich.

"Frontiers in Welding", by R. M. Gustafson, Research Engineer, Bureau of Aeronautics, Washington, D. C.

"Advanced Concepts in Solid Fuel Power Reactors", by W. H. Zinn, President, General Nuclear Engineering Corp., Dunedin, Fla.

Tuesday, May 5

9:30—"Nonferrous Foundry Techniques", by F. N. Rhines, University of Florida, Gainesville, Fla.

"Modern Metal Removing Techniques", by John W. Gottschall, Special Service Engineer, E. I. du Pont de Nemours & Co., Wilmington, Del.

2:00—"Refractory Metals", by R. Fischer, Battelle Memorial Institute, Columbus, Ohio

"Materials Research on the Space Frontier", by D. W. Gates, Chief, Materials Research Section, Research Projects Laboratory, Redstone Arsenal, Ala.

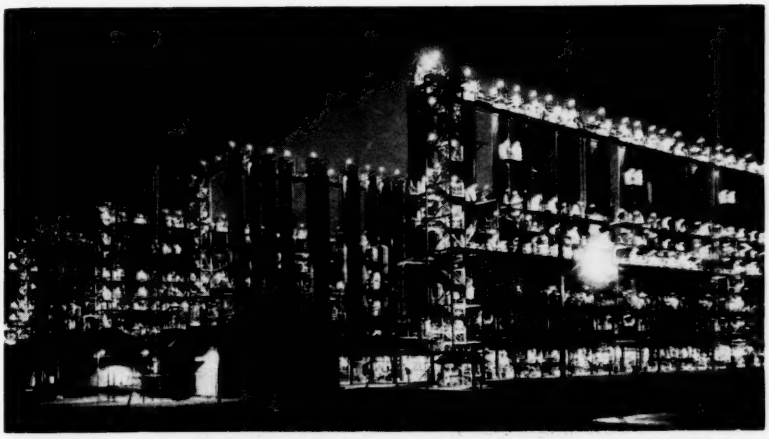
Wednesday, May 6

9:00—"The Savannah River Plant", by Robert C. Blair, Manager, Savannah River Operations Office, U. S. Atomic Energy Commission, Aiken, S. C.

10:00—Guided Tour, Savannah River Atomic Energy Plant

The Conference will be held in Augusta's Bon Air Hotel. Evening activities will feature an outdoor southern barbecue plus a colorful water show in the Bon Air swimming pool, as well as the traditional President's address and dinner dance. A complete ladies' program has been scheduled, including visits to the classical old homes and gardens in the Augusta area, the textile mills in nearby Horse Creek Valley, and the Fort Gordon Crime Laboratory.

The Savannah River Chapter, through Conference Chairman W. L. Worth, invites all A.S.M. members and friends to come to Augusta for what promises to be an outstanding event of the metallurgical year, the 1959 Southern Metals Conference. Inquiries may be addressed to the Chairman at 567 Banks Mill Road, S. E., Aiken, S. C.



The Heavy Water Production Facility, Shown by Night Above, Will be a Feature of the Tour of the A.E.C.'s Savannah River Plant During the 1959 Southern Metals Conference in Augusta, Ga., on May 4, 5 and 6

Discusses Gas Turbines

Speaker: R. F. Thomson

General Motors Corp.

"Automotive Gas Turbines" were discussed by R. F. Thomson, head, metallurgical engineering department, research laboratories, General Motors Corp., at **Canton-Massillon (Ohio).**

Dr. Thomson covered design and operating characteristics of full turbine and free-piston turbine engines and compared material requirements of the two types of engines.

The advantages of each engine were noted, with emphasis on the turbine type, which is much lighter in weight and contains far fewer parts. It offers no cold starting problems so antifreeze is not necessary. It's chief advantage is that it can operate on many types of liquid fuels, including many low-grade types.

Although the turbine engine has decided advantages over the conventional piston engine of today, replacement of piston with turbine types should be considered only after careful evaluation of economic and production factors.—**Reported by George Matthews for Canton-Massillon.**

Speaks on Aluminum Finishes

G. H. Kissin, Head, Finishing and Electrochemical Applications Branch, Department of Metallurgical Research, Kaiser Aluminum & Chemical Corp., Spoke on "Recent Developments in Finishing of Aluminum" at Golden Gate. Shown are, from left: H. E. Krayenbuhl, secretary; Dr. Kissin; and R. Ray, chairman

Speaker: G. H. Kissin

Kaiser Aluminum & Chemical Corp.

"Recent Developments in Finishing of Aluminum" was the subject of a talk by G. H. Kissin, Kaiser Aluminum & Chemical Corp., at a meeting of the **Golden Gate Chapter.**

Post-war years have seen the entry of anodized aluminum into the large architectural and automotive markets. Anodizing for such uses requires precise control of conditions to meet needs of color match, thickness and physical properties of the coatings. This in turn demands an understanding of the fundamental mechanism of the anodizing process. A knowledge of these basic mechanisms of anodizing gives us the tools with which to achieve useful new processes and improve old ones.

Anodizing is electrochemical oxidation of an aluminum anode to produce aluminum oxidizing coatings of controlled thickness, density and structure. Although 15% sulphuric acid at room temperature is the most common electrolyte used in this country, many other solutions may be used to produce anodic coatings for special requirements such as hardness, dielectric strength and preplating. An understanding of the peculiar structure of anodic coatings produced under different conditions in the various electrolytes is necessary to accomplish successful dyeing and building of desired physical properties.

Dr. Kissin explained that many aspects of anodizing behavior, particularly color and brightness, are controlled by the action of the anodizing bath upon alloying constituents in commercial aluminum alloys. The net result is to impart to each type of alloy a characteristic gross coloration and degree of transparency of anodic coating which is related to the composition and metallurgical structure of the alloy.

Studies of the behavior of alloying constituents have led to the concept of "built-in" anodized color. Inert or chemically converted alloying constituents are like inorganic pigments and, therefore, are usually light-fast. A number of new processes for architectural color anodizing are based on this concept.

Although plating on aluminum with the zinc immersion process is quite an old art, considerable improvement in corrosion performance has been achieved by eliminating zinc and copper in the preparation of aluminum for chromium plating. Instead an oxide film of controlled thickness and porosity is produced by anodizing in a special electrolyte. These improved plating methods lead to optimism for the eventual adoption of chromium plated aluminum for automotive bumpers, functional parts, appliances and utensils.—**Reported by Al Donlevy for Golden Gate.**

Demonstrates Drop Forging

T. L. Swansen, Ladish Co., Who Spoke on "Breaking Through Design Barriers With Drop Forgings" at a Meeting of the Peoria Chapter, Is Shown, Holding Gear, With W. C. Cadwell, Technical Chairman, R. L. Poehls and F. E. Simpson, Caterpillar Tractor Co., and an Unidentified Member, Back to the Camera

Speaker: T. L. Swansen

Ladish Co.

T. L. Swansen, vice-president, Ladish Co., spoke on the subject "Breaking Through Design Barriers with Drop Forgings" at a meeting of the **Peoria Chapter.**

The program began with the premiere showing of Ladish Co.'s newly released color film "Forgings Mark Progress", which traced the growth in size of forging tools and subsequent production of larger one-piece forgings. Elimination of undesirable operations and the use of fasteners, joints, etc., were mentioned as benefits to be derived from the use of these new tools.

Recent breakthroughs in the use of new metals, such as titanium, were mentioned by Mr. Swansen as significant steps forward for the forging industry. Future production of forgings made from two metals in one piece offers great possibilities. For instance, materials providing optimum properties of wear and machinability may be utilized in different parts of a single forging.

Slides provided a graphic illustration of the processes described. A number of sample forgings, made from both steel and titanium, were available for audience comparison. An informal question and answer session followed the formal presentation.—**Reported by W. M. Hallett for Peoria.**

Influence of Heat Treatment On Failures Topic at Muncie

Speaker: J. D. Graham

International Harvester Co.

J. D. Graham, chief material engineer, International Harvester Co., spoke on "Field Failures as Influenced by Heat Treatment and Machinery" at a meeting held by the **Muncie Chapter.**

Mr. Graham reviewed the basic fundamentals which, if properly applied, will eliminate most field failures, illustrating these fundamentals with slides, some of which were in color, to show stress lines in plastic models as viewed under polarized light.

Mr. Graham discussed fatigue and the known necessary stress loadings for safe nonfatiguing operation. He also discussed impact strength and how to avoid field failures by properly designing parts to compensate for impact forces. He described impact failures caused by operating out of the safe-temperature range of the metal and the failures caused by sharp radii and grinding damage.—**Reported by J. A. Buxton for Muncie.**

A. S. M. has produced and makes available for showing before chapters and educational institutions moving picture films pertaining to metals.

Metal Removal Methods

Norman Zlatin (Left), Metcut Research Associates, Inc., Who Spoke on "New Developments in Metal Removal" at a Meeting Held by the Washington Chapter, is Shown With H. Bernstein, Chairman of the Chapter.

Speaker: Norman Zlatin

Metcut Research Associates

"New Developments in Metal Removal" were described by Norman Zlatin, Metcut Research Associates Inc., at a meeting held by the **Washington Chapter.**

Ceramic tools available to industry are basically 98-99% aluminum oxide. Indicative of the developmental nature of this product is the wide variation in properties which users have found in tools obtained from different sources. The material is very hard but brittle, limiting its use at present to turning operations. Success has been achieved by some companies in using ceramic tools for high-speed machining when relatively light feeds which minimize impact are employed.

Mr. Zlatin described chem-milling, a process of shaping a piece of metal by dissolving off the excess material in an appropriate solution (acid or alkali). The "etchant" solutions are generally controlled to remove metal from areas not masked at a rate of about 0.001 in. per min. in depth. Undercutting limits the process to a practical depth of metal removed of ¼ in. Tapers, over-all reductions on complex shapes and light "cuts" on thin sheet are typical applications.

A group of relatively new machining processes employing the erosion principle for metal removal were then described. These include electrical discharge, electrolytic and ultrasonic methods.

The electrical discharge machining process consists of a series of electrical discharges occurring at the rate of 20,000 to 300,000 times per sec. between the tool and the workpiece. The spark discharge which passes through a gap spacing of 0.001 in. filled with dielectric oil vaporizes a small portion of the workpiece and this is washed away by the dielectric. The process is being used for drilling, die sinking and grinding operations on electrically conductive metals.

The electrolytic method is a reverse plating system and is performed with a conductive electrode wheel embedded with abrasive grains that protrude slightly above the wheel surface. Wheel and workpiece are submerged in a conductor fluid and a continuous low voltage direct current is passed between them. It is usually applied to grinding and cut-off work.

In the ultrasonic machining method the motion of an alloy steel tool oscillating linearly about 20,000 times per sec., with a stroke of a few thousandths of an inch, drives abrasive grains against a workpiece. The grains are carried in a liquid that continuously flows between the workpiece and the tool and which also serves to wash away the minute particles of metal removed from the workpiece. The shape of the tool determines the precise bombardment pattern of the grit against the workpiece. It can be used on nonconductive materials, such as jewel bearings.

The latest metal removal method available employs an electron beam as the cutter. In this system a very high-voltage beam, similar to an X-ray beam, is focused on the part to be machined with a magnetic field to a very fine beam, which, in effect, produces a series of very fine holes which trace out the shape of the piece of metal to be removed. This method is being used to cut out very small sections in thin stock.—**Reported by George Sorkin for Washington.**

Southeast Ohio Hears Talk On High-Temperature Steel

Speaker: J. J. B. Rutherford

Babcock & Wilcox Co.

John J. B. Rutherford, chief metallurgist, Tubular Products Division, Babcock & Wilcox Co., spoke on "High-Temperature Steel" at a meeting of the **Southeast Ohio Chapter.**

He traced the development of steels for use at elevated temperatures, and stated that development of better steels for use in boilers began in 1830 in an effort to decrease boiler explosions. This early work led to development of tensile tests at ordinary and elevated temperatures. In 1890 the French scientist LeChatelier found that the strength of steels depends upon the temperature as well as the speed of the testing. About 1910 United States and English metallurgists tried additions of chromium and nickel to improve corrosion resistant properties at elevated temperatures. Chromium has been found very effective in decreasing oxidation of steel at temperatures up to 2200° F.

In 1927 boilermakers tried using stainless steels containing about 18% chromium, with 8% nickel. These also were used as still tubes in oil refineries. Whereas previously the tubes had lasted only three or four weeks, the stainless steel tubes had a life up to 20 years.

In an effort to obtain lower cost, metallurgists developed a steel containing 5% chromium and 0.5% molybdenum during the depression in the 1930's. Numerous other compositions were developed and about 50 were in use by World War II. At that time the War Production Board reduced this to five.

At the present time boilers must be designed to last 20 years and still tubes for refineries are designed to last 10 to 15 years. Present-day boilers operate at temperatures of about 1100° F.

Mr. Rutherford stressed the importance of long-time creep tests to determine allowable stresses of boiler steels. He also discussed the design strength of various types of stainless steel at 1100-1500° F.—**Reported by H. W. Rathmann for Southeast Ohio.**

Covers Grinding Research

L. P. Tarasov, Left, Research and Development Department, Norton Co., Presented a Talk on "Grinding Research" at a Meeting Held by the Cincinnati Chapter, Is Shown With Fred Robertshaw, Chairman

A.S.M. has created the Metals Engineering Institute, the home study school of the metals industry.

Santa Clara Members Tour Ford Plant

From Left: H. T. Sumsion, Program Chairman, C. R. Thomson, Production Manager Ford Motor Co., and H. D. Ross, Secretary, Are Shown at a Meeting of the Santa Clara Valley Chapter Following a Tour of the Ford Plant

Speaker: C. R. Thomson
Ford Motor Co.

More than 150 members of the **Santa Clara Valley Chapter** learned first hand how an automobile is built when the group from San Jose, Calif., area industries toured Ford Motor Co.'s assembly plant at Milpitas.

Hosts for an evening that included an address by the plant's production manager and dinner in the plant cafeteria were members of the West Coast material quality laboratory.

Chairman of the program was H. T. Sumsion, research laboratory, Lockheed Missile Systems Division.

Charles R. Thomson, production manager of the San Jose plant, described the growth of Ford's Northern California operations in terms of physical layout.

The company's first automobile assembly plant in Northern California was opened in San Francisco about 1916. It had about 160,000 sq. ft. of space—roughly 3½ acres—and had a top one-shift production of 200 vehicles.

Mr. Thomson contrasted this first plant with the Richmond, Calif., plant with 348,000 sq. ft. of floor space and a productive capacity of 320 cars a day (on a single-shift basis) and the most recent Ford assembly plant which has 32 acres or 1.5 million sq. ft. under a single roof and which holds the record for the most units produced in one day on a single shift—a staggering 752.

This plant is building cars on a big scale, Mr. Thomson said. We have about 2500 people receiving an annual payroll of about $15 million. Since we began production in March 1955, we have built more than 776,000 cars and trucks.

Graphically portraying the logistics needed to keep this industrial giant functioning, Mr. Thomson cited the 60 rail carloads of parts, the 100 truck loads of stock and the $100,000 freight bill—all part of a day's operation at San Jose.

Stock arrives at such a rate that if we did not build cars for 30 days and still received stock, these parts would make a solid pile the size of the plant and rising 60 ft. into the air.

Mr. Thomson discussed the problems of building to order, developing production schedules and ordering, taking inventory and balancing out the nearly 13,000 separate parts used in car and truck production.—**Reported by R. N. Johnson for Santa Clara Valley.**

Quality Control Society To Hold 13th Convention

The 13th Annual Convention of the American Society for Quality Control will be held May 24 through May 27 in Cleveland. Registration, technical sessions and scheduled luncheons will be held at the Public Auditorium, a five-minute walk from the Hotel Sheraton-Cleveland, the headquarters hotel.

Sessions of interest to persons in the metallurgical field include the following lectures:

Control of Quality of Sheet Metal for Containers, by S. J. Hotchner, American Can Co.; Process Control of Continuously Extended Products, Such as Wire, Strip, Foil, Rubber, Paper, Plastic and Aluminum, a panel session; Bulk Sampling, by W. M. Bertholf, Colorado Fuel & Iron Corp.; Role of Product Engineering in Automotive Quality, by J. R. Parker, A. O. Smith Corp.; and Foundry Applications, by S. P. Zobel, Carborundum Co.

Other sessions covering the application of quality control techniques in the armed services and in the brewing and food industries, as well as lectures on education and research activities will be included on the program.

Complete information may be obtained from: Wade C. Weaver, Registrar, Republic Steel Corp., Cleveland 1, Ohio.

Los Angeles Features Disney Film

William Bosche of the Walt Disney Studios Presented a Film Entitled "Tomorrow the Moon" at a Meeting Held by Los Angeles Chapter. Shown are, from left: F. Arnold, Norris Thermador Corp.; Mr. Bosche; Stuart Oliver, chairman; and M. Tilley, technical chairman of the meeting

Speaker: William Bosche
Walt Disney Studios

William Bosche, Walt Disney Studios, presented a film of space studies and travel, entitled "Tomorrow the Moon", at a meeting held by the **Los Angeles Chapter.** The film covered the age-old moon mythology and then was developed around the space stations and rocket ships. Wernher Von Braun of the Army Ballistic Missile Agency was filmed discussing designing, launching and construction of the space satellite and moon rocket. An actual manned rocket flight around the moon was visibly portrayed, showing problems of materials and logistics of the trip.

Mr. Bosche then discussed the problems in shooting films of this nature. —**Reported by P. D. Schlosser for Los Angeles.**

Reviews Metals Behavior In Sea Water at Quebec

Speaker: T. Howard Rogers

Naval Research Laboratory

T. Howard Rogers, officer in charge, Naval Research Laboratory, Halifax, Canada, presented a talk on the "Corrosion Behavior of Metals and Alloys in Seawater" at a meeting of the **Quebec Chapter.** He introduced his talk by giving his definition of naval science as a practical art, not a science in the truly academic sense. Fighting ships are essentially practical. Throughout his talk, it was apparent that seawater had often foiled the superficial scientists.

Steel is the only material suitable for the major part of ship construction but it must be protected from the sea. No alloys have been found which resist corrosion more economically than steel protected by paint. Most of the other protective coatings do not last as long as paint and usually cause more corrosion after failure than if no coating were applied. Stainless steel is inferior to mild steel in many applications. A particular example cited was a steel pump shaft fitted with a bronze impeller. A mild steel shaft lasted for three years while a stainless steel shaft failed after a few months in the same application.

The ability of nonferrous metals to resist the various forms of corrosion varies tremendously. Ordinary 70/30 brass is very poor but may be greatly improved by adding a trace of arsenic as an inhibitor. Inhibited aluminum brass is the standard material for condenser tubes. Titanium tubes will last much longer; however, their use is not warranted because they outlast by far the life of the ship.

Some materials, such as Naval brass, have very deceptive names. By implication one would suspect that they were very good materials for seawater applications. In fact, it appears that Naval brass is only a variant of Muntz metal, an alloy invented by the British navy so that they could have an easily worked material which bore their name. The ability of both materials to resist seawater corrosion is poor.

Manganese bronze is another material which can be deceptive. The general name applies to a large variety of alloys, mostly of proprietary nature. As far as the resistance to seawater corrosion is concerned, it varies from poor to good, relative to the cost.

Other nonferrous metals, gun-metals, copper-nickel-iron alloys and cupro-nickels also possess good qualities. Certain aluminum wrought alloys are excellent when properly protected with zinc chromate paints, but some of the promising cast alloys break down in a manner which has not been adequately explained or counteracted. The basic problem is obtaining a strong alloy which will endure.

In closing, Mr. Rogers remarked that unless metals are greatly improved, plastics will certainly be applied in many seawater applications. **—Reported by C. Briercliffe for Quebec Chapter.**

THOMAS E. NEAL has been appointed general sales representative of Engelhard Industries, Inc. He will cover Florida, Alabama, Georgia and South Carolina, with headquarters in New Smyrna Beach, Fla.

♦ ♦ ♦

A. T. ENK is now manager of the design department of Surface Combustion Corp., Toledo.

♦ ♦ ♦

WILLIAM M. HARPER, previously with Ford Motor Co., has been appointed sales engineer in the Cleveland office of Pangborn Corp.

♦ ♦ ♦

J. M. SERVER, for the past two years supervisor of X-Ray Sales, has been appointed New York district sales supervisor by Ansco, the photographic manufacturing division of General Analine and Film Corp.

♦ ♦ ♦

WILLIAM EISMANN, JR., is now manager of national lubrication sales for E. F. Houghton & Co. He succeeds C. R. SCHMITT who was promoted to assistant to vice-president, sales.

♦ ♦ ♦

WILFRED R. OGG was appointed manager of distributor sales for Norton Co.'s Grinding Machine Division. CALVIN K. KIRK succeeds him as Chicago district manager and THOMAS D. BUSHMAN succeeded Mr. Kirk as product research engineer.

♦ ♦ ♦

Jones & Laughlin Stainless and Strip Div. announces that RUSSELL H. LOUTZENHISER, formerly in charge of production at the Detroit and Louisville, Ohio, plants, has been named division vice-president, production, with headquarters in Detroit, and EUGENE V. MORT, who was manager of production for the strip producing plants, is now division general manager, production.

♦ ♦ ♦

The directors of Norton Co. have elected DONALD L. PRICE a vice-president. He has been manager of grinding wheels for the Abrasive Division since 1955. ROBERT CUSHMAN, manager of marketing services, will succeed Mr. Price as sales manager, grinding wheels. HARRY G. BRUSTLIN, West Coast district manager, returns to Worcester to succeed Mr. Cushman.

♦ ♦ ♦

JOSEPH AZZOLINO, formerly assistant project engineer, Curtiss Wright Corp., has been appointed technical sales representative for Heatbath Corp., to cover northern New Jersey and metropolitan New York, with headquarters in Lodi, N. J.

♦ ♦ ♦

EVERETT C. GOSNELL, formerly with Ryan Industries of Cleveland, has joined Alloy Engineering Co., Berea, Ohio, as sales engineer.

♦ ♦ ♦

The board of directors, Picker X-Ray Corp., has announced the election of E. L. GRAY, manager of the Denver office, to vice-president, Picker X-Ray, Rocky Mountain, Inc., and JOHN KINGSTON DUNN of Sioux City, Iowa, as president of Picker X-Ray of Iowa, Picker X-Ray of Nebraska and Picker X-Ray Midwest, Inc.

♦ ♦ ♦

R. O. (Dick) WATSON has been appointed sales and service engineer for the South Indiana area of Northwest Chemical Co., Detroit.

♦ ♦ ♦

MERLE F. KOBLISH, assistant manager of sales, is now sales manager for basic industrial chemicals produced by Allied Chemical's General Chemical Div. He succeeds Arthur E. Foell who retired Dec. 31, after 41 years with the company.

♦ ♦ ♦

ROBERT D. JAMES has joined the A. M. Byers Co. as a field service engineer in the Houston Div. office.

♦ ♦ ♦

EUGENE J. HOCHDANNER has been appointed chief engineer at Latrobe Steel Co. He will be in charge of engineering design, installation and maintenance of buildings, equipment and facilities.

♦ ♦ ♦

JERRY F. HAISLIP has been promoted to sales engineer in the New York office of the Steel and Tube Div., Timken Roller Bearing Co., after completing a year and a half training course at the company's home office in Canton, Ohio.

♦ ♦ ♦

HENRY F. DEVER, vice-president of Minneapolis-Honeywell Regulator Co., and president of Brown Instruments Div., has been elected president of the Metal Manufacturers' Assoc., Philadelphia.

♦ ♦ ♦

HOWARD F. CARVER has been named assistant general manager of Gleason Works, Rochester. He is to continue as vice-president in charge of sales and member of the board of directors.

♦ ♦ ♦

Mallory-Sharon Corp., Niles, Ohio, announces the creation of a new administration group within its sales organization and has appointed LELAND W. LONG as administration manager. He will be responsible for the development of all plans and programs covering special metals sales areas.

Delivers Harder Memorial Lecture

Robert H. Heyer, Armco Steel Corp., Is Shown as He Received the Plaque Awarded by the Columbus Chapter to Commemorate the First Oscar E. Harder Memorial Lecture. Present were, from left: Mr. Heyer; T. L. Chase, chairman; John G. Kura, vice-chairman; and Francis W. Boulger, technical chairman. Portrait is of the late Oscar E. Harder, formerly consultant, Battelle Memorial Institute and Past President A.S.M. (1940-1941)

Speaker: R. H. Heyer

Armco Steel Corp.

Robert H. Heyer, supervising metallurgist for research, Armco Steel Corp., presented a talk on "Low-Carbon Steel Sheets—Mechanical and Crystallographic Properties" at the first annual Oscar E. Harder Memorial Night held by **Columbus.**

The meeting was opened with the presentation of an A.S.M. Scholarship Award to John Thomas Cammett, first-year student at Ohio State University's department of metallurgical engineering, by Mars Fontana, chairman of the department.

After some preliminary comments on the contacts which he had with Dr. Harder in his student days, Mr. Heyer reviewed the use of mechanical tests to evaluate drawability and directionality of low carbon steel sheets, including hardness, tension, hydraulic bulge, tear length, plastic anisotropy in tension, and various types of cupping tests. Precautions for obtaining reliable Rockwell hardness readings on steel sheets were mentioned.

It was shown that the hydraulic bulge test, using a heavily bolted draw ring, is a bi-axial stretch-forming test rather than a drawability test. The tear length test measures directionality of sheets caused by inclusion stringers or chain carbides. It will show differences in directionality between sheets from the top and middle of rimmed steel ingots, where no significant differences in crystallographic texture exist. On the other hand, the tension test for plastic anisotropy clearly reflects the degree and types of preferred orientation present in the sheet.

The conical cup test of Shinji Fukui, professor, University of Tokyo, was compared to the Swift cupping test, developed in England. The conical cup test, using a 60° entry angle, does not require a hold-down. One blank size is used for a range of sheet thicknesses. Since the test is always made to failure and evaluated as percent reduction in blank diameter, it is not necessary to explore a range of blank diameters as in conventional cup tests.

Conical cup test results on rimmed and aluminum-killed drawing steel sheets were related to results of Rockwell and plastic anisotropy tests.

Typical X-ray pole figures were shown for rimmed and aluminum-killed sheets. The principal types of preferred orientation found in the pole figures were identified. It was shown how each type of preferred orientation influenced the plastic anisotropy of the sheet, and how the total plastic behavior could be evaluated by study of the pole figures.

In the case of aluminum-killed steel sheets processed for the normal "pancake" grain, and for equiaxed grain structure, the superior drawability of the former is due to the type and degree of preferred crystallographic orientation of the pancake grain structure.—**Reported by Milton Weiner for Columbus.**

Compares Properties of Wrought and Cast Steels

Speaker: A. W. Morgan

Dept. of Mines & Technical Surveys

A. W. Morgan, Dept. of Mines & Technical Surveys (Canada), spoke on "Mechanical Properties of Wrought and Cast Steel" at **Quebec.**

Dr. Morgan expressed concern over the lack of published comparative data on wrought and cast steel, especially in view of the claims of various manufacturers of weldments and castings. As far as physical properties and production techniques are concerned, cast steel has certain advantages over wrought products. Many misconceptions based on past experience cloud popular beliefs.

The casting method is simple and direct, in some cases being the only feasible production method. The complexity of a casting is governed only by the ability to produce suitable patterns and molds. The casting method can also reduce overhead costs for engineering time, drawings and specifications. In general, there is little difference in strength between cast and wrought products.

Ductility and elongation properties are comparable for cast and wrought alloys at tensile strength levels up to approximately 120,000 psi. Unfortunately, the ductility of castings drops slightly at higher strength levels. One point quite often forgotten when comparing properties of cast and wrought products is the directional effect in wrought products. Specimens taken in the longitudinal and transverse directions are usually different. Casting properties are independent of direction, tensile strength being similar to the transverse strength of wrought products.

Fatigue properties are usually superior for unnotched wrought specimen in the longitudinal direction but are inferior to cast properties under all other conditions. The importance of surface finish favors neither material. A cast finish is equivalent to the usual lathe-turned surface.

Until 20 years ago, the low-temperature impact properties of products made from wrought alloys were usually considered better. The introduction of welding changed this situation. In welded structures there are usually small cracks and residual stresses which reduce the strength. The blame for loss of strength is not entirely due to the welding method but partly due to change from riveting. The holes in riveted structures formed natural barriers to cracks and the fabrication method does not result in large residual stresses.

Good material cannot cure poor designs or fabrication methods, consequently all factors must be considered. Some methods of fabrication are inherently better because they are less susceptible to defects. This is the case when castings and forgings are compared. When impact properties are important, usual commercial castings are superior to weldments. The inclusions found in castings have little effect if they are the correct type.

The introduction of new foundry melting and casting techniques has greatly improved the properties of cast products. Often the cast products are superior to wrought products designed for a similar function. —**Reported by C. Briercliffe for Quebec Chapter.**

Gives Survey of Fiber Metallurgy Techniques

Speaker: W. C. Troy

Solar Aircraft Co.

Walter C. Troy, staff engineer, Solar Aircraft Co., presented "A Survey of Fiber Metallurgy" at a meeting held by **Columbus Chapter.**

Mr. Troy noted that, with the exception of wire and wire forms, conductors, springs, bandings, fences, etc., metal fiber is the only directional bulk material. Metal powder has zero directional continuity; sheet has two directions of continuity; bars, billets and castings have three directions of continuity.

Fiber metallurgy is the combination of all or part of these operations—fiber manufacture, comminution, classification, suspension, handling, forming, pressing and sintering. Many of these operations are similar to powder metallurgy techniques; others are not (for example, the felting step is similar to the felting of papermaking).

Fibers are made from wools, shaved from wrought forms; wires, fine wrought wires suitably cut to length and curled; cast, filamentary form cast from the melt in a spinner cup device; or cut, fine filaments cut from wrought forms.

There are various methods for the fabrication of bulk fibers into useful forms. The earliest to receive attention was suspension in a liquid forming a felt and sintering the felt. Suspension media include glycerol, glycerol-water solutions, inhibited aqueous media, etc. Continuous felting of fiber metal strip has been combined with continuous sintering to form a fiber metal strip of indeterminate length.

Applications include: medium strength, extreme low-weight applications, filters where low pressure loss is required, filled or impregnated fiber metal bodies, flame impingment surfaces, etc.—**Reported by Milton Weiner for Columbus.**

Describes Atomic Powered Future at Albuquerque

Speaker: R. W. Henderson

Sandia Corp.

R. W. Henderson, vice-president, development, Sandia Corp., presented a talk entitled "Your Atomic Powered Future" at **Albuquerque.**

He discussed the world-wide status of conventional fuel supplies and the possibilities for atomic fuels in the future. He related figures on the world's population growth with figures on the world's fuel needs, and from these computations predicted the depletion of fossil fuels and the need for the development and use of atomic fuels. He also described some peacetime uses for atomic explosions. —**Reported by Gerrit J. Hof for Albuquerque.**

Reviews PH Stainless Steels

James H. Waxweiler, Armco Research Laboratories, Spoke on "Precipitation Hardening Stainless Steels" at a Meeting in Dayton. Shown are, from left: C. F. Heckel, treasurer; Mr. Waxweiler; W. J. Ridd, chairman; D. C. Heckard, vice-chairman; and R. A. Grayson, chapter secretary

Speaker: James H. Waxweiler

Armco Research Laboratories

Past Chairmen of the **Dayton Chapter** heard James H. Waxweiler, senior research engineer, Armco Research Laboratories speak on "Precipitation Hardening Stainless Steels".

Martensitic, austenitic, and semi-austenitic grades of precipitation hardening stainless steels were covered. The martensitic grades, such as 17-4PH and Stainless W, utilize a low-temperature aging treatment of 900 to 1100° F. to achieve their high hardness and strength rather than using high carbon to make hard martensite. This provides such advantages as no distortion or scaling during heat treatment, excellent weldability and corrosion resistance and easier machining. Several varied uses of these alloys were shown, including aircraft parts, motor boat shafts and control rod indicators on atomic reactors.

The double heat treatment or semi-austenitic grades of precipitation hardening stainless steels such as 17-7PH and AM350 have been competing with titanium and its alloys for years in the aircraft field. PH15-7Mo has gained widespread acceptance for high-speed aircraft not only because of high strength but because it satisfies production requirements in manufacture of honeycomb panels. These requirements include weldability, brazeability and compatibility of the brazing cycle with heat treatment of the steel.

Liquid fuel missiles and rockets have many of the same requirements as aircraft and have consumed large amounts of the PH steels. As solid fuel missiles have become more popular, corrosion resistance has become less important and interest shifted to the higher strength die steels such as Tricent, Vascojet 1000, etc. Just as honeycomb arose as a new manufacturing technique for supersonic jets, "automatic spinning" or "roll turning" is growing as a manufacturing method for these missiles or pressure vessels. This eliminates the longitudinal weld necessary in wrap-around methods of making a pressure vessel, and much higher burst pressures can be achieved.

As these cylinder sizes increase to 15-20 ft. diameter by 30-40 ft. length with a wall thickness of 0.040 in., the problems of heat treating and retaining shape have reached major importance. A new heat treatment has been developed for 17-7PH and PH15-7Mo which utilizes an austenite conditioning treatment of about 1200° F. rather than the 1800° F. temperature necessary for austenitizing the die steels. This heat treatment produces strength almost as high as the die steels with a much simpler process requirement.—**Reported by D. M. Ashfal for Dayton.**

New Films

Guided Mist

An 18-min. sound and color film released by Ransburg Electro-Coating Corp., shows Ransburg's newly developed electrostatic hand gun in operation, both in laboratory and in-plant production shots. The film is available for group showing through: Ransburg Electro-Coating Corp., Box 23122, Indianapolis 23, Ind.

A Product of the Imagination

A 16-mm. sound and color film depicting aluminum from the beginning of time to the launching pads at Cape Canaveral is the latest addition to Alcoa's film library. The film, which runs 26 min., is available through the Motion Picture Section, Aluminum Co. of America, 1501 Alcoa Bldg., Pittsburgh 19, Pa.

Lecture in Detroit on Heat Treating Theories

Wilson T. Groves, Dana Corp., Presented the First Lecture in the Detroit Series on "Modern Theories of Heat Treatment Atmospheres and Diffusion". He is shown, left, with F. B. Nair, technical chairman

Richard E. Grace, Purdue University, Gave the Second Lecture in the Detroit Chapter Series on "Modern Theories of Heat Treatment". Dr. Grace, right, is shown with Nicholas M. LaZar, technical chairman

Speaker: W. T. Groves

Dana Corp.

The first of a series of two lectures on "Modern Theories of Heat Treatment Atmospheres and Diffusion" was presented by the **Detroit Chapter** for its 1958 Fall Educational Program. Wilson T. Groves, chief metallurgical engineer, Dana Corp., gave the first lecture entitled "Gas Equilibrium Data and Its Application to Heat Treating Atmospheres". Technical chairman was Frank B. Nair, Jr., Climax Molybdenum Co. of Michigan.

Mr. Groves gave a comprehensive presentation on the theory and application of equilibrium data for gas atmospheres generally encountered in the heat treating of steels for the automotive industry. He devoted substantial time to discussing the manner in which the gas equilibrium equations were derived from the first and second laws of thermodynamics, free energy of chemical reactions and its relation to the equilibrium constant.

Sample problems were worked out by Mr. Groves to depict the practical use of the theoretical equations. Six graphs were plotted, for temperatures from 1500 to 1750° F., showing the relationship of % CO_2 vs. % CO for various carbon potentials ranging from 0.20% C to saturated austenite. Another plot gave the relationship of % water by volume to the dew point temperature and the final graph showed the close agreement between Mr. Groves' calculated curves and the experimental results attained by Cullen and Koebel for the relationship of dew point temperature to surface carbon concentration.

The lecture was concluded with a description of a Dana four-zone carburizing furnace containing atmosphere manifolding for automatic control of the carbon concentration by the dew point method.—**Reported by Peter Ilitch for Detroit Chapter.**

Speaker: R. E. Grace

Purdue University

"Carburizing Kinetics" was the title of the lecture presented by Richard E. Grace, associate professor of metallurgical engineering, Purdue University, in the **Detroit Chapter's** educational series on "Modern Theories of Heat Treatment".

Dr. Grace prefaced his lecture with a review of the steady and unsteady state concepts. Mathematical equations were developed historically to show how early concepts were revised and applied to the generally similar cases of the flows of heat, electrical charge, mass and momentum. Components of the similar equations were explained in terms of fluxes, driving forces or gradients and specific coefficients.

Illustration of steady state diffusion conditions and limiting conditions for the validity of mathematical analyses were reviewed. Similar considerations were made for unsteady state characteristics.

The use of boundary conditions was described and illustrated for steady and unsteady state problems. Some complicating features of the steady state concept, such as unknown or varying concentration gradients, were outlined. A variety of common boundary conditions was reviewed for unidimensional infinite and semi-infinite slabs. Handling of the error function (erf.) was illustrated.

Application of Newman's Rule was shown to result in solutions for finite shapes. Variations of the diffusion coefficient with concentration and temperature were also considered.

Following the mathematical considerations of the steady and unsteady states, Dr. Grace solved several sample problems in heat treatment of steels. He showed how to handle calculations for estimating time required to reach given carbon contents at subsurface locations, if starting carbon content, atmosphere carburizing potential and temperature are known. Other applications of diffusion calculations where also illustrated.

Technical chairman for the meeting was N. LaZar, professor, Wayne State University.—**Reported by D. G. McCullough for Detroit.**

Ladies Entertained at Indianapolis

Shown at the Ladies Night Meeting Held by the Indianapolis Chapter Are, From Left: S. F. Kuhn, Production Manager, Herff-Jones Co., Who Gave a Talk on "Beauty in Precious Metal"; Chairman and Mrs. Carl Weber; and Vice-Chairman and Mrs. Charles Patton. (Reported by Dorothy Holbrook)

Describes Space-Age Metals

W. H. Steurer, Left, Convair Division, General Dynamics Corp., Is Shown Being Presented a Speaker's Certificate by Harold Berstein, Chairman of the Washington Chapter. Dr. Steurer gave a talk on "New Material Developments for the Space Age"

Speaker: W. H. Steurer

Convair Division
General Dynamics Corp.

Members of the **Washington Chapter** heard a talk on "New Material Developments for the Space Age" by Wolfgang H. Steurer, Convair Division, General Dynamics Corp., at their Students Night Meeting.

Dr. Steurer gave a short history on rockets and then discussed problems encountered in getting a rocket or missile through space. One of the major problems results from the heat generated when a missile passes through the earth's atmosphere. At a speed of Mach 8 skin temperature reaches about 2000° F., at Mach 15 the temperature rises to about 6000 to 7000° F. Combustion chambers can be cooled but structural members are not as easily cooled, particularly the exposed surface of missiles.

Since flight through the atmosphere is of short duration, measured in minutes and seconds, it is not necessary to use materials that are stable for long times at high temperatures. Metastable metals can be used which retain their high strength for a short time. For example the strength, at 1000° F., of a low-alloy high-strength steel, cold rolled quarter-hard, is 40% higher in strength than when in the annealed condition during a time interval of less than 1 min. Precipitation hardening steels can be conditioned on fabricated missile parts.

At high temperatures consideration is given to thick metal sections, using their thermal capacity for heat absorption. Controlled melting of the exterior surface is another means to absorb heat from the structural material, but in doing so, the wall thickness decreases. An orderly and efficient "ablation" requires, however, a certain combination of thermal properties. There are no known existing metals that exhibit both high heat content and low thermal conductivity. Heterogeneous materials that act as insulators and heat absorbers appear promising. Such a combination should prevent heat transfer into the interior of the missile and confine the heat absorbing melting to a minute layer of the exterior surface.

Materials can be tested using a rocket jet blast against experimental nose cones for missiles to simulate high temperatures. Ceramics spall when subject to this test; ductile ceramics presently undergoing development may exhibit satisfactory performance. Heterogeneous silica systems have been tested successfully. Fiberglass reinforced plastics exhibit even ablation when subject to the blast from the jet. The combustion gases, however, are not the same as the environment at high altitudes. There are several other methods of simulation testing in use or in development, of which the Plasmajet appears to produce the best representation of the thermal environment for the purpose of material investigations.

In space, problems arise from new environmental conditions such as the almost perfect vacuum, solar and cosmic radiation, meteorites and even dust. Dust, 0.030 in. particle size, can be serious at high velocities.

During the meeting, Thomas R. Shives, a senior student in metallurgy at the University of Maryland, was awarded an A.S.M. scholarship. Another student, Harvey Yakowitz, was presented a membership certificate to Alpha Sigma Mu.—**Reported by R. E. Lyons for Washington.**

Reviews Russian Tour

N. J. Grant (Right), Department of Metallurgy, Massachusetts Institute of Technology, Spoke on His "Metallurgical and Philosophical Tour of Russia" at a Meeting of the Savannah River Chapter. He is shown with Roger Mittelberg, vice-chairman

Wilmington Hears Talks On Hydrogen in Metals

Speaker: Maynard Hill

Westinghouse Electric Corp.

Maynard Hill, research metallurgist, Westinghouse Research Laboratories, discussed "Hydrogen in Metals" at **Wilmington.**

Mr. Hill described experiments on the solubility and diffusivity of hydrogen in iron and steel. The solubility in annealed materials increases with increasing temperature. At temperatures below about 250° C., cold work causes a large increase in the solubility such that the solubility actually increases with decreasing temperature. The diffusivity is found to be unusually low in this same temperature region. Both of these effects become more severe as the carbon content and degree of deformation is increased. It is assumed that the cold worked structure contains traps which accumulate hydrogen. The similarity of the behavior to chemisorption phenomena indicates that the hydrogen is trapped as chemisorbed atoms on cracks which form in pearlite during deformation.

Recent theories of hydrogen embrittlement were reviewed. Embrittlement by hydrogen is a temperature dependent phenomena whereby relatively small contents in the range 1-10 ppm. can decrease the ductility of forging steels by as much as 50%.

Mr. Hill concluded with a discussion of the possible role of chemisorption on cracks in this phenomena. In this it was proposed that the hydrogen pressure within cracks is relatively low. The cracks propagate at lower than normal stresses because the adsorbed hydrogen lowers the energy required to form a new surface. Research efforts give more support to this theory than to arguments in which it is proposed that the hydrogen is trapped as atoms in vacancies and dislocations or as molecules under high pressure in voids.—**Reported by R. G. Bowman for Wilmington.**

Recent Research in Steel

"Some Recent Research in Steel" Was the Subject of a Talk by Oscar T. Marzke, U. S. Steel Corp., at a Joint Meeting of Washington Chapters A.S.M. and A.W.S. Shown are, from left: Michael F. Godfrey, A.W.S. chairman; Dr. Marzke; and H. Bernstein, chairman

Speaker: O. T. Marzke

U. S. Steel Corp.

Some current research being carried out at the Fundamental Research Laboratory of U. S. Steel Corp., primarily concerned with a study of factors that influence mechanical properties, was presented by Oscar T. Marzke, vice-president, Fundamental Research, at a meeting of **Washington Chapters** A.S.M. and A.W.S.

Using electron microscope techniques, it was observed in studies of the transformation of austenite to pearlite that the carbide lamellae do not touch the austenite-ferrite interface (optical micrographs show no such gap). The existence of this gap has lead to the development of a model for the transformation reaction. This model can account quantitatively for the effect of temperature and qualitatively for the influence of alloying elements on the austenite-pearlite transformation.

In view of the many discrepancies that exist in the literature on both the shape and composition of the carbide precipitates that are formed during the aging process in low-carbon steels, extensive electron microscope studies using the electron replica technique have been carried out. It has been found that the carbides formed in specimens quenched to room temperature and then aged at a higher temperature have a complex dendritic appearance. When aged at low temperatures the dendrites are fine and lacy—when aged at higher temperatures they become more compact and massive. On specimens quenched directly to the aging temperature, both dendritic and oblong plate-like structures are found. In all cases, electron defraction data show the carbides to be cementite.

An electron micrograph having a magnification of 500,000× was shown to illustrate the form that titanium carbide takes on precipitation from stainless steel. These carbides are thin, rectangular plates and are stacked like playing cards that have been fanned out. Several electron micrographs were also shown to illustrate the appearance of dislocations in stainless steel.

Evidence was given to show that hydrogen and nitrogen reach an "equilibrium value". This value varies with the extent of cold work—the more the cold work, the higher the value. The increase in this value has been found to be directly proportional to the increase in the atom vacancies caused by the generation of dislocations during the cold working. This suggests the formation of a hydrogen or nitrogen dislocation compound analogous to that of a chemical compound.

Finally, some preliminary information was given to show the improvement in physical properties that may be possible through application of some of the basic concepts on formation and locking of dislocations. Under one set of test conditions, stainless steel that had been processed by a combination of cold working and precipitation gave a rupture life approximately ten times greater than that of untreated material. Its minimum creep rate was also lowered almost 100-fold. The preliminary nature of these results was emphasized, and the necessity for more work to determine if such results can be consistently obtained without any detrimental effects was pointed out.—**Reported by R. M. Gustafson for Washington Chapter.**

Describes Embrittlement

Bernard R. Queneau, Assistant Manager for Metallurgy, Inspection and Research, Tennessee Coal and Iron Division, U. S. Steel Corp., Who Spoke on the "Embrittlement of Steels" at a Meeting of Oak Ridge, Is Shown, Left, With R. J. Gray, Technical Chairman

Speaker: B. R. Queneau

Tennessee Coal and Iron Division
U. S. Steel Corp.

Members and guests of the **Oak Ridge Chapter** heard B. R. Queneau, assistant manager for metallurgy, inspection and research, Tennessee Coal and Iron Div., U. S. Steel Corp., speak on "The Embrittlement of Steels".

Mr. Queneau described his topic as "data we all know, but don't all use". He defined embrittlement as a marked loss in ductility with little change in other mechanical properties and presented a series of slides illustrating points in his discussion.

Some of the points covered were the influence of crystallographic factors on embrittlement, embrittlement by phase changes or gases, and the effects of loading and shape on embrittlement. The latter was illustrated with Grossman's well-known slide showing the effect of the type of notch on the transition temperature for hardened steels quenched and tempered at 400° F. to a hardness of over 500 BHN, and a quote from E. C. Bain, "metals are not brittle; shapes are brittle".

Proceeding to temper brittleness, which was defined as the loss in notch toughness which occurs on tempering alloy steels above 700° F., and especially in the 900-1000° F. range, the speaker emphasized the effects of temper brittleness on mechanical properties and described variations in embrittlement rate due to carbon, phosphorus, manganese, chromium, nickel and molybdenum.

Tempered martensite brittleness was described as loss in toughness of martensitic steels at high hardness levels upon tempering at 400-700° F. It was explained as a precipitation phenomenon resulting from the formation of epsilon phase and the subsequent precipitation of cementite platelets.

The final forms of embrittlement covered were the 885° F. and sigma phenomena found in the stainless steels. The causes for "885 embrittlement" were reported as still problematical, with the most likely explanation being the precipitation of some intermediate high-chromium phase, perhaps as the result of lattice distortion in the high-chromium steels. Sigma was described, along with its attendant loss in ductility and increased hardness, as forming from the heating of high chromium (>12%) stainless steels in the 1050-1300° F. range. Sigma is found in austenitic stainless steels as well, but is usually not a problem because of the great ductility.—**Reported by A. Goldman for Oak Ridge.**

Problem in Understanding Alloy Effects in Steels Subject at Louisville

Speaker: E. E. Stansbury

University of Tennessee

E. E. Stansbury, professor, University of Tennessee, and national trustee, A.S.M., presented a talk before a meeting of **Louisville Chapter** on "Some Problems in Understanding Alloy Effects in Steels".

It has been recognized for a long time that the mechanical properties of steels are largely governed by the microstructure resulting from heat treatment. Chemical composition is considered to exert only minor direct influence. The chemical composition does have the important effect of changing the cooling rates which are necessary to obtain a given microstructure.

For applications of heat treated steels where reasonable ductility is required, suitable tempering temperatures may be found that will yield the same tensile strength for different amounts of nonmartensitic products in the structure. These nonmartensitic products are now known to impart reduced properties such as the ratio yield strength to tensile strength and impact ductility to the steel. Therefore, in critical applications, the results of slack quenching (as heat treatment to structures containing nonmartensitic products is called) must be considered. Dr. Stansbury emphasized, however, that a critical evaluation of required properties for a given application be made. Frequently maximum properties are not required and needless expense would be incurred in requiring highly alloyed steels. Also, parts are frequently loaded such that stresses are a maximum on the surface and low enough in the center to tolerate large amounts of nonmartensitic products. In fact, shallow hardening steels may produce favorable residual stresses.

To prevent slack quenched structures formation of the nonmartensitic products, ferrite, pearlite and bainite must be retarded (i.e., the hardenability must be increased).

The austenite-pearlite transformation has received the greatest study and it is well established that most alloying elements retard its nucleation and growth. How the alloying elements accomplish this is not very well understood. Possible mechanisms for the alloy effect are (1) decrease in rate of diffusion of carbon, (2) necessity for diffusion of the more slowly moving alloying element, and (3) interference of alloying elements with interface reactions converting austenite to ferrite plus cementite. There is now evidence that the latter is controlling. Why one alloying element is more effective than another is not clear.

By increasing hardenability it is possible to obtain more nearly identical structures in many section sizes. At the present time these "identical" structures do not always show exactly the same properties, particularly with regard to impact and notch tensile behavior. Thus the nickel steels will frequently show better properties. Whether nickel is showing a characteristic effect or is producing changes in structure which have not been recognized remains to be shown. —**Reported by J. J. Hodapp for Louisville Chapter.**

Summer Courses Scheduled

John P. Nielsen, Chairman, Dept. of Metallurgical Engineering, New York University, New York 53, N. Y., has announced that the following short courses will be held during the summer months:

June 1-2—Vacuum Metallurgy
June 15-19—Thermo-Electric Materials and Devices
June 29-July 3—Ductile Iron
Sept. 14-15—Titanium

Information about the courses can be obtained directly from Prof. Nielsen.

Boston Chapter Honors Its Past Chairmen

Shown Are Several of the Past Chairmen of the Boston Chapter Who Attended a Meeting Held in Their Honor. Speaker at this meeting was D. J. Blickwede, director of physical metallurgy, research Division, Bethlehem Steel Co., who spoke on the subject, "Cooling Transformation of Steels"

Speaker: D. J. Blickwede

Bethlehem Steel Co.

At the Past Chairmen's Night held by **Boston Chapter,** D. J. Blickwede, division head of physical metallurgy, research department, Bethlehem Steel Co., spoke on "Cooling Transformation of Steels".

Dr. Blickwede explained that the primary reason for alloy additions to steel is to increase physical properties. In heat treating the highly alloyed steels, slower cooling rates may be used than with steels of a lower alloy content. Thus alloy content and cooling rate control the properties of steel.

In discussing continuous cooling, Dr. Blickwede showed the formation of ferrite, pearlite, bainite and martensite. He pointed out that the structure produced by continuous cooling is not the same as that produced by isothermal transformation. Thus I-T diagrams cannot be used to predict the hardness and structure obtained in practical heat treatments.

Dr. Blickwede discussed end quench procedures and structure formation to better understand the problems associated with establishing continuous cooling curve diagrams. Specimens were heated, placed in the Jominy fixture and rates of cooling from ⅛ to 3 in. were thoroughly checked. Jominy specimens were end quenched for various times and then quenched over-all in brine to freeze in the structure as it existed along the Jominy bar. The bars were examined for the beginning of formation of ferrite, pearlite, bainite and martensite. In this way the cooling transformation diagram was constructed. The continuous cooling diagram thus obtained gives an excellent indication of how steel will actually transform during heat treatment.

Dr. Blickwede concluded by stating that a considerable amount of research has to be done to learn more about the higher temperature transformation of steel before an atlas of continuous cooling curves is available.—**Reported by Stephen G. Demirjian for Boston.**

West's Growth and Potential Topic at Old-Timers Night

Speaker: F. J. Robbins
Sierra Drawn Steel Corp.

Frederick J. Robbins, president, Sierra Drawn Steel Corp., presented a talk, "Technically the West Is Coming of Age", before a joint meeting of the **Los Angeles Chapter** and members of the Quarter Century Metals Club*.

Mr. Robbins contrasted the importance of both the business pioneer and the technical man in the development of industry in the West. He summarized the growth of Western industry by dividing his discussion into the three main periods of industrial developments: the 15 years preceding World War II; the years of the War; the 15 years following World War II.

In the 15 years prior to World War II, the economy of Southern California was based primarily on agriculture, oil production, tourism, construction and the movies. Industrially this area was a consuming marker with limited manufacturing facilities.

The local steel industry, for instance, which is always a hallmark of industrialization, produced only those items used in construction. All alloy steel, toolsteel and specialty items were imported from the East. During these periods most steel was procured from warehouse distributors who contributed immeasurably to the growth of the West through their service and financial assistance during these infancy stages of Southern California industry.

Such industries as Douglas Aircraft Co., Baker Oil Tools, Inc., Security Engineering, U. S. Spring and Bumper, Harvey Machine, Norris Stamping and Manufacturing Co. and Pendleton Tool Industries were just starting. Today these companies enjoy national and international recognition for their accomplishments in the years since the early 30's. Douglas Aircraft now has a two billion dollar backlog, Harvey Machine is building a 63-million dollar aluminum reduction plant. The oil tool industry ships hundreds of oil tools to all parts of the world. Norris Stamping enjoys the position of one of the largest metal fabricators in the United States, achieving special recognition for their work on steel shell casings. Pendleton Tool Industries furnishes from 15% to 18% of the national market for mechanics hand tools.

*Quarter Century Metals Club—Men who have been associated with the Southern California metals industry on the executive level for at least 25 years.

The war period stimulated the growth of Western industry. However, during a war it is possible to operate a business with reasonable success under almost any condition. Costs are unimportant, profits easy to make and an infinite amount of capital available. However, the wartime, because of its urgent requirements, did foster the development of many new ideas and new ways of doing things.

The real problem of industrial development came in the aftermath of the war when all of the physical facilities and mental abilities resulting from that war had to be put to a worthwhile and profitable use. It was during this post-war period that the mettle of Southern California's industry was really shown.

In the early 40's and late 30's California had very little in the way of metallurgical organization. Most industries were dependent on the technical assistance provided by the various steel mills then operating in the area. For instance, in 1940, the Los Angeles Chapter A.S.M. had only 200 members; its present membership is 1064 and it ranks fifth in size in the nation. If San Fernando Valley membership were included, it would rank third. Members of the local chapter contributed much to the field of nondestructive testing, chemical milling, new techniques of heat treating and greatly furthered the use of new metals, new alloys and exotic materials not thought important ten years ago.

The future presents many challenges, such as rocket tranportation, automation and electronics applications, which have heretofore been only dreams in the eyes of so-called science fiction writers.

The steel industry must also keep pace with modern technology. For instance, the use of boron, which 20 years ago was unknown, as an alloy in steel, has resulted in the production of standard boron steel products. We now know small additions of columbium to low-carbon steel just about doubles its strength with only a nominal increase in price. The rare earths have similar benefits which to date are only a potential.

Steel as a basic industry is fundamental to the economy of the U. S. and of Southern California. It offers a benchmark for the growth of industry in Southern California. In 1940 the west produced about 600,000 tons of steel and consumed 2.2 million tons. The war years brought production up to 3.1 million tons, but we consumed 4.5 million tons. By 1955, nine million tons were being consumed locally and only 6.4 million tons produced. As yet the industry had not kept pace with its customers. Local steel producers are rapidly expanding facilities and more expansion is predicted for the future.

Based on a survey by Stanford Research Institute, by 1975 the population of the United States will be 212 million and of this, 22 million will reside in California alone. By the year 2000, there will be 273 million in the United States and 60 million in California. In 1946 every person in the U. S. consumed 700 lb. of steel per year; in 1956, 1460 lb. per man of steel per year. At 1500 lb. per person in 20 years, Southern California alone will need to expand its steelmaking capacity 400% within the next 20 years without considering any possible increases in consumption.

The West has been attractive to industry because of favorable climate, good labor pool and brainpower, an excellent local market, transportation facilities and sufficient availability of utilities at low cost. These ideal conditions can only mean that in the next 30 years, unlimited possibilities for the expansion of Western industry will exist. The past 30 years of Southern California have given a solid foundation both technically and industrially on which to build the future and the next 30 years cannot fail to be even more eventful.—**Reported by E. C. Buckingham for Los Angeles.**

M.E.I. Course Given at Worcester

Pictured Is a Class in Metallurgy Being Held at Worcester Polytechnic Institute Under the Sponsorship of the Worcester Chapter. The 39 men were taking one of the Metals Engineering Institute courses, and diplomas were awarded to those successfully completing the course. The instructor, left, was Roy F. Bourgault of Worcester Polytechnic Institute

CHAPTER MEETING CALENDAR

Albuquerque	**May 21**		**J. L. Waisman**	Fatigue and Life Testing
Baltimore	**May 18**	(Tri State)	**W. Crafts**	Materials for High-Speed Flight
Boston	**May 7**	M.I.T. Faculty Club	**J. C. Fisher**	Magnetism and Magnetic Alloys
Calumet	**May 12**	Mergus Restaurant	**H. E. VanValkenburg**	Ultrasonic Inspection of Materials, Theory, Equipment and Application
Carolinas	**May 7**		**C. H. Lorig**	National Officers Night
Cedar Rapids	**May 12**	Roosevelt Hotel	**Tom Rice**	Machining
Chicago-Western	**May 15**	Old Spinning Wheel		Ladies Night
Cleveland	**May 4**	Engineering Society	**Panel**	Machinability
Columbus	**May 6**	Broad St. Christian Church	**V. E. Lysaght**	Hardness Testing
Dayton	**May 28**	Walnut Grove Country Club		Social
Delaware Valley	**May 20**		**T. D. Taylor**	Modern Free Machining Steel
Golden Gate	**May 4**		**W. R. Smith**	Problems Associated With Welding of Components in a Nuclear Power Plant
Hartford	**May 1**	Statler Hotel		New England Regional Meeting
Indianapolis	**May 18**	Village Inn	**R. F. Thompson**	Automotive Gas Turbine
Lehigh Valley	**May 1**	Hotel Bethlehem		Ladies Night
Mahoning Valley	**May 12**		**W. E. Jominy**	Hardenability Relationships
Montreal	**May 4**			Past Presidents Night
Muncie	**May 12**		**Fred Webere**	Gray Iron, Physical Properties and Heat Treatment
New Jersey	**May 18**	Essex House	**H. J. Williams**	Principles of Magnetism
New York	**May 4**	Brass Rail	**F. K. Bloom**	Stress-Corrosion Cracking
North Texas	**May 7**		**G. A. Fisher**	Today's Metallurgy for Engineers
Oak Ridge	**May 20**	Rathskeller		Ladies Night
Ontario	**May 1**	Prince George Hotel	**W. E. Jominy**	Hardenability Relationships
Philadelphia	**May 14**	Engineers Club	**J. F. Libsch**	Metallurgical Aspects of High-Frequency Heating
Philadelphia (Jr. Section)	**May 14**	Engineers Club		(With Philadelphia Section)
Purdue	**May 19**		**R. F. Thompson**	Are Metallurgists Prepared for 19XX?
Rochester	**May 11**	Manger-Seneca Hotel		Annual Meeting
Rockford	**May 27**	Hotel Faust	**C. H. Lorig**	Fruits of Metallurgical Research
St. Louis	**May 21**	Ruggeri's	**M. A. Scheil**	Effect of Aging Treatments on the Corrosion Resistance of Austenitic Stainless Steels
Texas	**May 5**	Engineers Club	**G. A. Roberts**	Properties of Powdered Metals, Toolsteels and High-Strength Steels
Toledo	**May 14**	Maumee River Yacht Club	**O. W. McMullen**	Mile Posts in Metallurgy
Tri-City	**May 12**		**J. F. Victory**	Problems in High-Speed High-G Flight
Tulsa	**May 5**	Alvin Hotel	**T. Waller George**	Metallurgy of Synthetic Fibers
Washington	**May 11**	Dodge Hotel	**C. H. Lorig**	National Officers Night
Western Ontario	**May 8**	Windsor		Metal Bonding Materials
West Michigan	**May 18**	Schnitzelbank	**C. H. Lorig**	Selection of Materials in This Changing World
Wilmington	**May 13**	Sammy Green's	**H. A. Godfrey**	Metallurgy of High-Strength Steel Wire

Gives a Glimpse of Inside Russia

"Metallurgical and Other Observations Inside Russia" Was the Subject Discussed by John F. Elliott, Associate Professor of Metallurgy, Massachusetts Institute of Technology, at the Ladies Night Meeting of the Carolinas Chapter. Shown are, from left: W. Austin, vice-chairman; Mrs. Austin; Dr. Elliott; and Dr. Elizabeth Welch, professor, Salem College, who gave the coffee talk. (Reported by W. K. Hile for the Carolinas)

IMPORTANT MEETINGS

for May

May 9-11—American Institute of Mining, Metallurgical and Petroleum Engineers, Inc.: Annual Uranium Symposium, Uranium Local Section, Moab, Utah. (Ernest Kirkendall, Secretary, A.I.M.E., 29 W. 39th St., New York 18.)

May 17-20—American Institute of Chemical Engineers: National Meeting, Muehlebach Hotel, Kansas City, Mo. (F. J. Van Antwerpen, Executive Secretary, A. I. Ch. E., 25 W. 45th St., New York 36.)

May 18-20—Instrument Society of America: Annual Symposium, Shamrock-Hilton Hotel, Houston, Tex. (Richard Rimbach, Secretary, I.S.A., 845 Ridge Ave., Pittsburgh 12.)

Discusses Controlled Atmospheres

Shown at a Meeting of the Worcester Chapter Are, From Left: W. J. Nartowt, Technical Chairman; Orville E. Cullin, Manager of Research and Development, and Chief Metallurgist, Surface Combustion Corp., Who Spoke on "Controlled Atmospheres for Heat Treating"; and Leonard L. Krasnow, Chapter Chairman, Who Presided. (Photograph by C. W. Russell)

Ladies Entertained at Dayton

Present at the Annual Ladies Night Meeting Held by the Dayton Chapter Were, From Left: H. D. and Mrs. Henkel; Wilbur H. Pfeiffer, Who Gave a Talk on "Porcelain Enamel and the Home"; and Mrs. R. A. Grayson. Mr. Pfeiffer is head of the finishes section, materials and process engineering, Frigidaire Div., General Motors Corp. (Reported by D. Ashfal)

President Lorig Guest at Columbus

Clarence H. Lorig, National President A.S.M. and Past Chairman of the Columbus Chapter, Was Guest of Honor at Columbus Chapter's Annual National Officers and Ladies Night Meeting. He spoke on "Metals and Mrs. America". Present were, from left: Chairman and Mrs. T. L. Chase; Dr. and Mrs. Lorig; Mrs. Oscar E. Harder, widow of Past President Harder

Discusses Dimensional Changes in Toolsteels

Speaker: S. G. Fletcher
Latrobe Steel Co.

Stewart G. Fletcher, vice-president, metallurgy, Latrobe Steel Co., presented a talk entitled "Dimensional Changes in Toolsteels" before **Hartford Chapter.** He divided dimensional changes into volume and shape changes, the former caused by phase changes during heat treatment, and also with time, the latter by stresses.

His excellent slides illustrated how the crystallography of the transformations from ferrite to austenite to fresh martensite to tempered martensite affect volume changes during heat treatment.

Dr. Fletcher emphasized that shape change due to nonsymmetrical stresses is difficult to predict. He stated that in this field there is need for much definitive research work, since most of what we know on the subject today has resulted from practical experience.

The tendency of a solid cylindrical high-speed steel specimen to go out of round slightly during hardening as a result of prior steelmaking practice was illustrated. Although these changes are only a few ten thousandths of an inch they are nevertheless intolerable in some precision tools.

In a brief discussion of "time", Dr. Fletcher emphasized that to obtain this aging stability, steel must have a stable microstructure, one that has been tempered thoroughly, or a compensating microstructure, one with balanced growth and shrinkage. The necessity for care in balancing microstructure was illustrated by the fact that the transformation of 1% retained austenite produces dimension change of 0.00014 in. per in.

In all problems of dimensional change, an apparent inability to reproduce results may well be due to normal statistical variation.—**Reported by H. Hubbell for Hartford.**

OBITUARIES

FRANK O. FISCHER, a member of the Chicago Chapter and a 25-year member A.S.M., died in Tinley Park, Ill., on Jan. 29.

♦ ♦ ♦

LEO A. NEHRANDT, vice-president of Joseph Dixon Crucible Co., died unexpectedly on Feb. 11, at the age of 62. He was an expert in metallurgy, ceramics and refractories.

♦ ♦ ♦

PAUL KLAIN, a member of Saginaw Valley Chapter, and a group leader in the metallurgical laboratory of the Dow Chemical Co., died on Mar. 3. He was a nationally recognized authority on the welding and fabrication of magnesium and its alloys.

Compliments

To CLYDE WILLIAMS, noted metallurgist and president of Clyde Williams & Co., who received the James Douglas Gold Medal of the A.I.M.E. for his outstanding contributions in nonferrous metallurgy, particularly through stimulating research and interest in the basic metallurgy and use of common and less common metals.

♦ ♦ ♦

To M. E. MERCHANT, senior research physicist for the Cincinnati Milling Machine Co., who will receive the 1959 American Society of Lubrication Engineers' National Award at the Society's annual meeting in Buffalo, Apr. 21-23. Mr. Merchant is a member of the Cincinnati Chapter.

♦ ♦ ♦

To the SPECIAL LIBRARIES ASSOCIATION on its 50th Anniversary celebration. One of the most active groups in the association is the Metals Division. Organized as the Metals Section of the Science Technology Division in 1950, it became an independent division in 1953. Present membership is about 275.

Reports on Fatigue Tests On Aircraft Structures

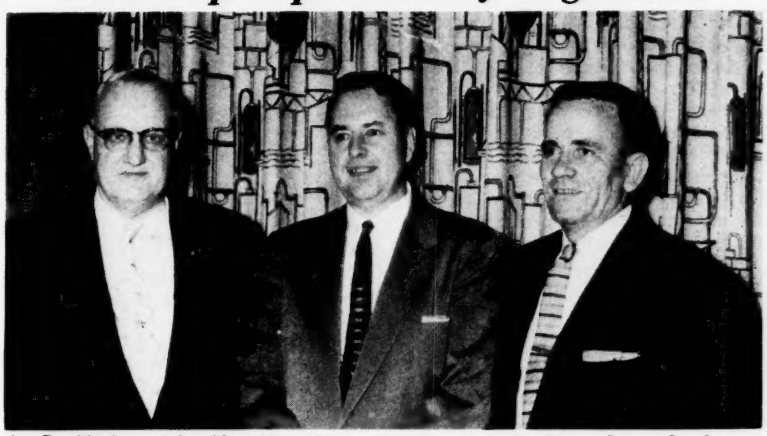
Speaker: R. W. Brown

Douglas Aircraft Co., Inc.

Russell W. Brown, chief of the structures design section, Douglas Aircraft Co.. Inc., Tulsa Division, spoke on "Fatigue Test and Evaluation of the DC-8 Fuselage Structure" at a **Tulsa** meeting.

The information presented by Mr. Brown was the subject of a paper presented at the 11th Technical Conference of International Air Transport Assembly at Monte Carlo last year by the chief engineer of Douglas' Santa Monica Division. He presented the results of an underwater fatigue and fail-safe test program on the DC-8 fuselage. Data from this program have been especially useful in evaluating and organizing inspection procedures for high-altitude jet transport airplanes. An equivalent of 40 to 120 years of endurance under simulated service loads was imposed on the specimen. Damage propagation rates and fail-safe characteristics of the structure were studied under these deliberately prolonged exposures of fatigue which were beyond the scope of experience permissible in actual service. The purpose was to present actual data taken from this test. The presentation included actual crack rates and maximum crack lengths attained. It also included a discussion of the critical locations in which these cracks occurred and the improvements incorporated in all production DC-8 airplanes as a result of these tests.—**Reported by A. B. Marks for Tulsa.**

Points Up Importance of Magnesium



J. S. Kirkpatrick, Vice-President, Brooks and Perkins, Inc., Spoke on "Magnesium and Magnesium Alloys" at a Meeting of the North Texas Chapter. He brought out the importance of the metal as a secondary alloying constituent as compared to the primary usage of the alloys which are basically magnesium. Shown are, from left: Earl L. Casey, vice-chairman; Mr. Kirkpatrick; and C. E. Perkins, chairman of the Chapter

Outlines Philosophy of Measurement

Francis G. Tatnall, Vice-President and General Manager, Tatnall Measuring Systems Co., Presented a Talk on the "Philosophy of Measurements in Metallurgy" at a Meeting of Chicago Chapter. Shown are, from left: Edward J. Leonard, technical chairman; William Wilson, chairman; Mr. Tatnall; and John B. Moser, Chairman of the Northwestern Student Chapter

Past Chairmen Honored at Calumet

Past Chairmen Present at a Meeting Held Recently by the Calumet Chapter Included, From Left: E. T. Schwendemann, J. R. Woodfill, F. S. Sutherland, T. A. Foss, J. A. Rassenfoss, M. A. Jones and P. H. Parker

Lindberg Completes Course

The Mar. 16 meeting of the **Chicago-Western Chapter** was the occasion for presentation of M.E.I. certificates to 19 heat treaters from the Lindberg Steel Treating Co. This group began the course "Heat Treatment of Steel" in August 1958 under the direction of K. H. Peterson, Lindberg's director of industrial relations. A number of plant metallurgists shared the teaching honors.

Mr. Peterson indicated that "All participants are extremely enthusiastic about the lessons. We are interested in lining up another program for the coming year".

Another company that has instituted an M.E.I. program, using the "Elements of Metallurgy" course, has indicated that "These lessons are excellent and well organized. Our class is progressing very satisfactorily and, of the 30 registrants, no one has shown an inclination to drop out".

Companies also like to use M.E.I. courses for individuals as well as groups. As one Ohio firm puts it: "We are quite enthusiastic about the work you are doing for the metals industry in making courses available for home study. It is now possible for men employed in areas where there are no engineering schools, and for others who cannot attend classes because they travel, to improve their knowledge of metalworking".

METALS ENGINEERING INSTITUTE **NEWS**

Three Share Honor

Three men share the honor of being the first students to graduate from the M.E.I. course entitled "Stainless Steels". Final examinations were received simultaneously in the M.E.I. office from Saunders Bloom, John Boltres and Willie Watson.

Mr. Bloom is a salesman for Continental Metals, Inc., Los Angeles; Mr. Boltres works for Republic Steel Corp., Canton, Ohio, where he is a senior melter; Mr. Watson, a civilian employee at Kelly Field, Tex., is a physical properties inspector.

The course on "Stainless Steels" was written by Charles Mayne and David McDowell of International Nickel Co. It covers properties, forming, corrosion resistance and heat treatment of various types of stainless steel.

Recognition Grows

Twenty-five M.E.I. in-plant training groups have been formed to date and have reached various stages of completion. Students now enrolled in 41 of the 50 states and in 20 foreign countries, are enthusiastic about M.E.I. and what it is doing for them. Letters arrive daily with comments like the following:

". . . more people should know of the excellent courses offered by the A.S.M. at a nominal fee."

". . . the comments from students (of a General Electric in-plant group taking "Elements of Metallurgy") were quite favorable . . . we have had several inquiries regarding more advanced and specialized courses."

". . . enjoyed the course very much and would recommend it for anyone who works with metals . . . makes an excellent reference for facts that are not readily available."

The Rocketdyne Division of North American Aviation has recently joined the growing roster of companies that have added M.E.I. to their list of approved schools, so that employees studying the courses can be reimbursed under their tuition refund plan.

See p. 34 for additional information on Metals Engineering Institute.

METALS ENGINEERING INSTITUTE IS ON THE MOVE

A Group of 19 Men From Lindberg Steel Treating Co., Chicago, Recently Completed a 15-Lesson Course Entitled "Heat Treatment of Steel" of the A.S.M.'s Metals Engineering Institute. Shown with the group are Lindberg staff members and A. Brasunas, M.E.I. director. From left, bottom row, are: K. H. Peterson, director of industrial relations, J. Skoczek, W. Whaling, W. Manley, F. Minch. Second row, from left: R. Cabel, H. Kramer, S. Hulak, Dr. Brasunas, C. Knable and E. Konior. Standing are, from left: J. Vandeman, R. Sinnott, L. Miller, R. Calto, H. Schlatholt, H. G. Magnussen, vice-president, L. Brown, D. Manley, W. Kopp, R. Sandnes, A. Hamilton, T. J. Corcoran and C. Schneider

Meet Your Chapter Chairman

COLUMBIA BASIN

LAWRENCE J. CHOCKIE comes from Denver, Colo. After completing business school he took a job as secretary to the personnel manager of a mining company. The association there created such a keen interest in engineering that he enrolled in the Colorado School of Mines. He continued to work for the mining company in various summer jobs, from summer-time tree planting to crew chief of mineral land surveying parties. After graduation, a short term with Gates Rubber Co. in Denver stimulated an interest in the field of testing and he is now in charge of the materials testing laboratory, Hanford Atomic Products Operation, General Electric Co., Richland, Wash.

Mr. Chockie is active in chapter affairs and for the past several years has been an officer participating in the northwest chapters' coordinating activities. He is also on the planning commission of the Joint Engineers Council. His active hobby is photomechanical and technical photography, and he was awarded a membership in the George Eastman House for intensive interest and development in the field of photography. Lighter interests include sailboating, gardening and garden architecture.

A true service man, Mr. Chockie served a stint in the Navy as electronic technician and was 1st Lt. in the Army Engineers through World War I. His wife is also from Denver and they have two children.

CLEVELAND

KENNETH J. HUMBERSTONE was born in Columbus, Ohio. He has the B.S. degree in metallurgical engineering. He was formerly with Carnegie Illinois Steel Co. and Aluminum Co. of America, is now vice-president of the American Tank & Fabricating Co. of Cleveland.

Ken has served as chairman of many local committees, was secretary and vice-chairman of his chapter A.S.M., and is also a member of the American Welding Society and American Institute of Metallurgical Engineers.

Mr. Humberstone is a member of the Masons and very active in church affairs, plays golf for recreation and makes a hobby of electronics. He has three children.

BRITISH COLUMBIA

HORACE A. NORQUAY was born at Norway House, Manitoba, at a Hudson's Bay Co. trading post where his father was medical officer. He attended the Universities of Saskatchewan and British Columbia for short periods and took his first job in the laboratory at Manitoba Foundries and Steel, Selkirk. He left there to go to Westland Iron & Steel, Vancouver, and after three years as a wireless operator in the R.C.A.F., went to work for A.I.M. Engineering. Mr. Norquay is now general manager of McLeod & Norquay Ltd., heat treating specialists.

A member for 12 years, he has served as chairman of student activities, secretary and vice-chairman.

Mr. Norquay has two daughters. For recreation he and his wife, the former Marion Roantree, play bridge and enjoy curling, baseball, football and hockey, as spectators.

EDMONTON

HERB BEAR was born in Kamsack, Saskatchewan. After receiving his B.S. degree in mechanical engineering from the University of Saskatchewan he took his first job at Richardson Road Machinery as draftsman, and was chief engineer at the same company for 12 years. He was with Northwest Industries for several years and is now chief engineer of Canadian Equipment Sales & Service Co., Ltd.

Herb served as chapter treasurer for three years, and is active in other technical societies as well as social clubs, curling and skiing being his recreational interests. His family consists of two boys and a girl, which gives him ample opportunity to practice his interest in photography.

WESTERN ONTARIO

WILLIAM A. MCINTYRE has been a member of A.S.M. for 16 years, and recently served four years on his chapter's Executive Committee. Born in Toronto, he started out as a chemical laboratory assistant at Ontario Research Foundation, then as chemical metallurgist at General Motors Corp., and plant metallurgist with Thompson Products, where he is now technical sales representative. He has four children, is active in his church affairs, and is a member of the Optimist Club.

BUFFALO

JOHN L. LAMONT has been a member of A.S.M. for 23 years. Born in Malden, Mass., he graduated from Lehigh University and started his career with Union Carbide & Carbon Laboratories, Inc. He is now group manager of Electro Metallurgical Co., Niagara Falls Division of Union Carbide Corp.

Mr. Lamont is also a member of A.I.M.E. and the Niagara Club, and his recreational interests center on fishing, music and touring.

UTAH

JACK F. MAY was born in Salt Lake City. Now general manager of Lundin & May Foundry Co., Salt Lake City, he has been with this company ever since graduating from Woodbury College in Los Angeles, except for the time during World War II when he was technical sergeant in the U. S. Marine Corps, serving in the Pacific area.

Jack belongs to the Masonic Order, is a Shriner and a director of the Utah Chapter, American Foundrymen's Society. Lighter interests include hunting, fishing and flying. He has two children.

L. J. Chockie

H. A. Norquay

Herb Bear

J. L. Lamont

W. A. McIntyre

Quarterly preprint list

Address Requests to:

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7301 Euclid Ave.
Cleveland 3, Ohio

The following papers will be preprinted for distribution to members of the American Society for Metals upon request. Order the papers by their numbers.

The six papers herewith listed represent the 1959 second quarterly preprinting of papers accepted by the Transactions Committee for inclusion in the annual volume of the Transactions of the Society. A brief abstract of each paper is included.

131. The Effect of Selenium on the Machinability and Tensile Properties of 5% Chromium Steel, by F. W. Boulger, Chief, Division of Ferrous Metallurgy, Battelle Memorial Institute, Columbus, Ohio.

On a weight basis, selenium is more effective than sulphur in improving the machinability of hot work die steels. The presence of 0.05% selenium improved the machinability ratings of annealed samples by 8% in laboratory tests. The improvement exceeded 50% in tests on bars heat treated to 330 Brinell. There is little doubt that improvements of the order noted in these experiments would be important in commercial machining operations. Larger amounts of selenium or sulphur produced slightly better machining properties.

Variations in sulphur and selenium contents up to about 0.22% had no significant effect on tensile properties of annealed samples. This was also true of samples heat treated to strengths around 278,000 psi., and taken parallel with the direction of rolling. On the other hand, such high metalloid contents lowered the ductility of transverse specimens heat treated to that strength level. This undesirable effect was not evidenced by steels containing up to 0.18% selenium and normal sulphur contents.

132. The Thermo-Mechanical Method for Relieving Residual Quenching Stresses in Aluminum Alloys, by H. N. Hill, R. S. Barker and L. A. Willey, Engineering Design Division, Alcoa Research Laboratories, New Kensington, Pa.

A summary of the development of a treatment that substantially reduces residual stresses caused by quenching during heat treatment. The treatment relieves residual stresses by introducing thermal gradients opposite to those which created the stresses during the quenching operation. Application of the treatment has no effect on mechanical properties. This thermo-mechanical treatment promises to make stress relief possible for irregularly shaped products that cannot be handled by other stress-relieving methods.

133. The Role of Boron in Cast Austenitic Alloys, by R. W. Kraft, Jr., United Aircraft Corp., East Hartford, Conn. and R. A. Flinn, Dept. of Chemical & Metallurgical Engineering, University of Michigan, Ann Arbor, Mich.

As the boron content of a simple austenitic alloy is raised by increments to 1.5% B, progressive, important changes in structure and mechanical properties at ambient (70°F., 21°C.) and elevated (1500°F., 816°C.) temperatures are obtained. These materials provide interesting speciments not only for the study of the role of boron in heat resistant alloys but also constitute good models for exploring the role of a gross precipitate in affecting mechanical properties at ambient and elevated temperatures.

Above 0.3% boron significant amounts of complex borides are obtained. These form a brittle network which dominates the resulting mechanical properties at *ambient* temperatures, reducing elongation to below 5%.

By contrast, the tensile and stress rupture properties at 1500°F. (816°C.) increase continuously with added boron with only minor effects upon elongation. The *massive* borides have little influence, being relatively mobile and following the flow pattern of the matrix. The boron at these temperatures exerts its effect by a precipitate in the *matrix* areas which becomes visible after testing at 1500° F. The amount of the precipitate, evidently a boride, increases at higher boron levels. The creep properties are improved further by pretreatment at 2150°F. which conditions the specimen for pronounced precipitation under stress, particularly at subgrain boundaries.

134. Retained Austenite in Precipitation Hardening Stainless Steels, by G. Krauss, Jr., and B. L. Averbach, Dept. of Metallurgy, Massachusetts Institute of Technology, Cambridge, Mass.

An X-ray diffraction technique was used to determine the retained austenite contents of a 17Cr-7Ni-1Al and a 17Cr-4Ni-3Mo alloy after various heat treatments. The retained austenite contents of these alloys after solution treatments were quite high, in the neighborhood of 60-80%., but subsequent treatments reduced the austenite contents to 7-10%. The austenite contents increase in the 17Cr-7Ni-1Al alloy on aging at temperatures between 700 and 1100°F. and it appears that the increase in hardness accompanying the aging treatments is the result of a precipitation reaction in the martensite. The formation of martensite on cooling from an intermediate temperature or on refrigeration below room temperature appears to be the primary mechanism of hardening in the 17Cr-4Ni-3Mo alloy.

135. An Exploration of High-Boron Alloys, by A. U. Seybolt, Metallurgy and Ceramics Research Dept., General Electric Research Laboratory, Schenectady, N. Y.

About 27 high-boron alloys were examined in a survey of the potentialities of such alloys for possible high-temperature applications. The chief tools used were X-ray diffraction, metallographic examination and hot hardness. It appeared that alloying boron with up to 6 atom. % of the following elements provided no appreciable ductility: Ga, Y, Ce, Si, Sn, Ti, Zr, Nb, Ta, Mo, W, Re, Fe, Ni and Co.

It was not feasible to make any mechanical property measurements other than hot hardness because of the extreme brittleness of the boron alloys.

Nuclear Power in the Metals Industry

"Nuclear Power and Its Effect on the Metals Industry" Was the Subject Discussed by F. L. Lawton, Aluminium Laboratories Ltd., at a Meeting Which Was Held in Montreal. Shown are, from left: R. Thompson, chairman; Mr. Lawton; and I. H. MacPherson, Vanadium-Alloy Steel (Canada) Ltd.

Speaker: F. L. Lawton
Aluminium Laboratories Ltd.

At a meeting of the **Montreal Chapter**, **F. L. Lawton**, chief engineer, power department, Aluminium Laboratories Ltd., spoke on the probable outlook for the application of "Nuclear Power in the Metals Industry". He covered many aspects of the economics of power supply for the metals industry in Canada, the United States and elsewhere in the world. His observations dealt with the conventional types of power supply in the form of hydro-electric and thermal power generation, the latter from the usual fossil fuels such as coal, oil and natural gas.

In developing the subject the speaker noted:

1. There are still very substantial amounts of undeveloped hydro-electric power in Canada and abroad which can be developed for two to three mills per kwh. Many of these sites abroad are reasonably close to deep water transportation.

2. There are a number of areas where power can be generated from coal for all-in costs of somewhat over four mills per kwh. Some of these are well located with respect to water transport and markets.

3. While nuclear power may be economic in some areas of high fuel cost for general power needs, nuclear power, now estimated to cost 7.5 to 12 mills per kwh. on the basis of 1957 cost levels and investor financing some 10 to 15 years or more ahead, remains exceedingly high-cost power for an industry as dependent on cheap energy as the metals industry.

4. Hydro-electric power may rise slowly as regards capital costs. Thermal-power cost is likely to rise more steeply because it is vulnerable to increases in cost levels for construction, for fuel and for labor. Further improvements in efficiency will be small and slow. On the other hand, nuclear power will probably show a decreasing capital cost as experience is gained, offset by increased cost levels for construction materials and labor. Closing the gap between costs of nuclear power and hydro-electric and thermal power, attractive to the metals industry, may therefore take much longer than some proponents of nuclear power would have us believe.

Major observations as to the effect of nuclear power on the metals industry, drawn from the foregoing, were:

1. In the field of prospecting, discovery and development of ore deposits, nuclear power will play no part.

2. In actual mining operations, nuclear power may be used where other sources result in prohibitively high energy costs such as in remote desert areas, in the Arctic and in other equally difficult areas. The likelihood of substantial development of this nature during the next 25 years will be governed by the demand for such ores, for instance, as iron from Ungava. It is not great.

3. Nuclear power is not likely to play an important part, for many years, in transportation in the metal industry.

4. Nuclear power and heat may be used, to a limited extent, where some processing and concentration of ores must be done before shipment from remote mines where other fuel costs are very high.

5. It is extremely doubtful that nuclear power will be used, other than to a very minor extent, for the smelting of metals, during the next 25 years or more.

It appears extremely improbable that nuclear power will have any significant effect on the metals industry for many years to come. Its application will only become attractive when nuclear power costs can be guaranteed less than those from conventional power plants, either hydro-electric or thermal. There appears, in brief, little reason to doubt that, provided the metals industry is allowed to expand along sound economic lines and is not impeded by artificial quota restrictions, duties designed to protect a less economic source of production or hidden subsidy serving the same end, it can readily find the low-cost power from hydro-electric or fossil-fuel sources needed to provide minimum-cost production in adequate volume.—**Reported by R. H. Peck for Montreal.**

Some preliminary information was obtained on the nature of the constitution of some of these binary systems. One rather unique complex phase was discovered in the B-Y system.

136. Precipitation Process in Copper-Chromium Alloys, by R. O. Williams, Senior Research Supervisor, Cincinnati Milling Machine Co., Cincinnati, Ohio.

A study of the precipitation process of chromium from supersaturated copper alloys at 400 and 500°C. using primarily X-ray diffraction, dimensional changes and mechanical properties. The first stage of the process consists of the precipitation of very thin plates coherent on the (111) planes. The second stage consists of the competitive growth of these particles to give maximum strength and to eventually lose coherency. This system appears to be unique in that the observed diffuse effects arise not from the precipitate but from the matrix due to displacement produced by the precipitate.

25-Year A.S.M.'er

William F. Allen (Right), Molybdenum Corp. of America, Was Presented a 25-Year Membership Plaque at a Meeting in York by E. T. Vitcha, Chairman

Metallurgical News and Developments

A Department of *Metals Review*, published by the American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio

Devoted to News in the Metals Field of Special Interest to Students and Others

New Technique—Combining plaster mold and investment casting techniques has greatly increased design possibilities for precision castings produced by Atlantic Casting & Engineering Co. Many castings that were either impossible or too expensive to produce by normal cope and drag techniques may now be produced.

New Process—Economical refining of aluminum, chromium, titanium, zirconium and other metals is possible with a process using chlorine at 4500 to 6000° F., according to Salem-Brosius, Inc.

Sandwich Metal Paneling—Republic Aviation Corp. announces a corrugated metal paneling for jet airplanes and space craft that is light weight and withstands 2000° F. temperatures while under pressure. Panels consist of corrugated metal between sheets of high-temperature-resistant metals such as stainless steel and Inconel X.

Special Meeting—The 13th Exhibition Congress of Chemical Engineering, organized by DECHMA, will be held in Frankfurt from June 9 to June 17, 1961. It will include the following exhibits: research and literature; new chemical substances; nuclear science and techniques; laboratory techniques; measurement control and automation techniques; structural materials techniques; works techniques; pumps and fittings; packaging techniques; auxiliary materials and consumable stores; accident prevention and works safety precautions.

Metal Coating System—B. F. Goodrich announces an adhesive which keeps its grip beyond the point where all other vinyl-to-metal adhesives fail. Sheet metal bonded to vinyl with the new A-978-B cement can be stretched 35% without weakening the bond or damaging the vinyl coating.

Die Forming Alloy—A high-strength zinc-base die metal alloy has been developed by American Smelting & Refining Co. One of the most significant features of the new alloy, Formaloy, is its high impact strength. Formaloy also has higher tensile strength, smoother die surface and uniformly fine, dense grain structure. For information write: American Smelting & Refining Co., Federated Metals Div., 120 Broadway, New York 5, N. Y.

Missile Program—Stanford Research Institute is broadening its research program on high-temperature materials for use in missiles. Two specialists in high-temperature metallurgy have joined the staff, and a large plasma generator, which will be used to study the behavior of new metals and refractory compounds with high melting points, has been acquired.

Research Program—A contract has been awarded to Lynn J. Ebert, Dept. of Metallurgy, Case Institute of Technology, for research directed toward a better understanding of plastic flow kinetics or deformation characteristics of metals at various strain rates and temperatures. Also awarded support is Robert F. Hehemann, associate professor of metallurgy, Case Institute of Technology, for his research on probing the fundamental properties of new alloys to be used in the construction of nuclear reactor cores. Both men are members of A.S.M. Dr. Hehemann was the 1958 recipient of A.S.M.'s $2000 teaching award.

Production Institute — Sponsored by A.S.T.E., the first annual institute will be held May 4 and 5. The following topics will be of special interest to metallurgists: "Explosion Forming of Metals to Meet Space Production Demands", "Grinding of Space Age Materials", "Hydro Spinning and Flow Forming" and "Chemical Milling". For further information write Prof. B. M. Aldrich, Coordinator, Dept. of Mechanical Engineering, University of Wichita, Wichita 14, Kan.

Summer Course—An intensive program of instruction and practice, designed to train personnel in the fundamental principles and proper application of nondestructive test methods, will be held Sept. 14-25 at Ohio State University, Columbus 10.

Vacuum Resistance Furnace — The first high-vacuum resistance furnace with the hot zone capacity to handle production as well as laboratory work and with the ability to operate at temperatures as high as 2400° C. has been developed by NRC Equipment Corp., Newton, Mass.

X-Ray Course—Two special courses in "X-Ray Diffraction Analysis" will be held this summer at Illinois Institute of Technology. The schedule is as follows: The Powder Method in X-Ray Analysis, June 8-12, and Advanced Methods in X-Ray Analysis, June 15-19. For further information write: Leonid V. Azarhoff, Illinois Tech, Technology Center, Chicago 16.

Austrailian Conference—The Twelfth Annual Conference of the Australian Institute of Metals will be held in Brisbane from May 25-29. Any A.S.M. members present in Australia will be welcomed at the conference.

Engineering Conferences—Plans are now being completed for the University of Michigan's 1959 summer program of intensive noncredit courses for practicing engineers and scientists. For information write: R. E. Carroll, Coordinator of Engineering Summer Conferences, University of Michigan, 2038 Engineering Bldg., Ann Arbor.

Annual Conference—The Sixth Annual Conference for Engineers and Architects will be held May 1 at The Ohio State University. The conference will present a program of outstanding speakers and discussion sessions. For information write: General Chairman, Ohio State University, College of Engineering, Columbus 10.

Achievement Award—The Copper & Brass Association has announced an award competition to honor the year's most significant advancement in the use, application or metallurgy of copper, brass, bronze or other copper-base alloys. Winner will receive a cash prize and bronze award, to be presented at the annual meeting on May 13. Entry forms and full information are available from: Copper & Brass Research Assoc., 420 Lexington Ave., New York 17.

EMPLOYMENT SERVICE BUREAU

The Employment Service Bureau is operated as a service to members of the American Society for Metals and no charge is made for advertising insertions. The "Positions Wanted" column, however, is restricted to members in good standing of the A.S.M. Ads are limited to 50 words and only one insertion of any one ad. Address answers: c/o A.S.M., 7301 Euclid Ave., Cleveland 3, O., unless otherwise stated.

POSITIONS OPEN

East

METALLURGIST: B.S. in metallurgy or equivalent education and minimum of five years industrial experience, to act as consultant to design and manufacturing engineers in application and fabrication of wrought and cast aluminum and magnesium alloys. Should have experience or interest in preparation of material specifications and engineering documents. Laboratory experience desirable. Mail details of experience. Box 4-5.

GRADUATE STUDY AND RESEARCH IN PHYSICAL METALLURGY: Distinguished university has openings for qualified applicants to do research on shock loading, physical properties of intermetallic compounds and liquid metals. Full schedule of courses for M.S. or Ph.D. degree may be carried. Box 4-10.

OPENHEARTH — BLAST FURNACE RESEARCH: Excellent opportunity for metallurgical engineer with steelmaking experience to head research program directed toward improved blast furnace and openhearth practice. Desire good experimentalist and idea man. Opportunity to "get in on the ground floor" of new research department. Adjacent to top residential areas in suburban Philadelphia. Send resume to: R. A. Lubker, Director of Research and Development, Alan Wood Steel Co., Conshohocken, Pa.

METALLURGICAL ENGINEER: To be responsible for material specifications and heat treat specifications, with emphasis on ferrous physical metallurgy of highly stressed gears and other components of small high-speed mechanisms. To work with research, development and manufacturing engineers, also factory foremen. Opportunity to work with some plastic components, rubber components and product lubrication problems. Minimum of four years experience required. Send resume to: G. W. McCarty, Vice-President, Research and Development, The Black & Decker Mfg. Co., Towson 4, Md.

SENIOR METALLURGIST: With physical metallurgy, ceramics or related background for research programs concerned with advanced reactor fuels and components. Advanced degree or equivalent related nuclear experience necessary. Send resume and salary requirements to: H. S. Wilson, Connecticut Aircraft Nuclear Engine Laboratory, Box 611, Middletown, Conn.

RESEARCH CHEMIST AND EIGHT PHYSICAL METALLURGISTS: Interested in long-range research program in southern New England. Write giving information on educational background, work experience and salary expected. Consideration may be given to men with limited experience but with proper theoretical experience. Box 4-15.

METALLURGICAL LABORATORY SUPERVISOR: Progressive and long-established firm serving the steel industry, internationally, needs seasoned man to take charge of new metallurgical laboratory. Address in confidence: G.E.D., Borthaugh Farm, R.D. #2, Nazareth, Pa.

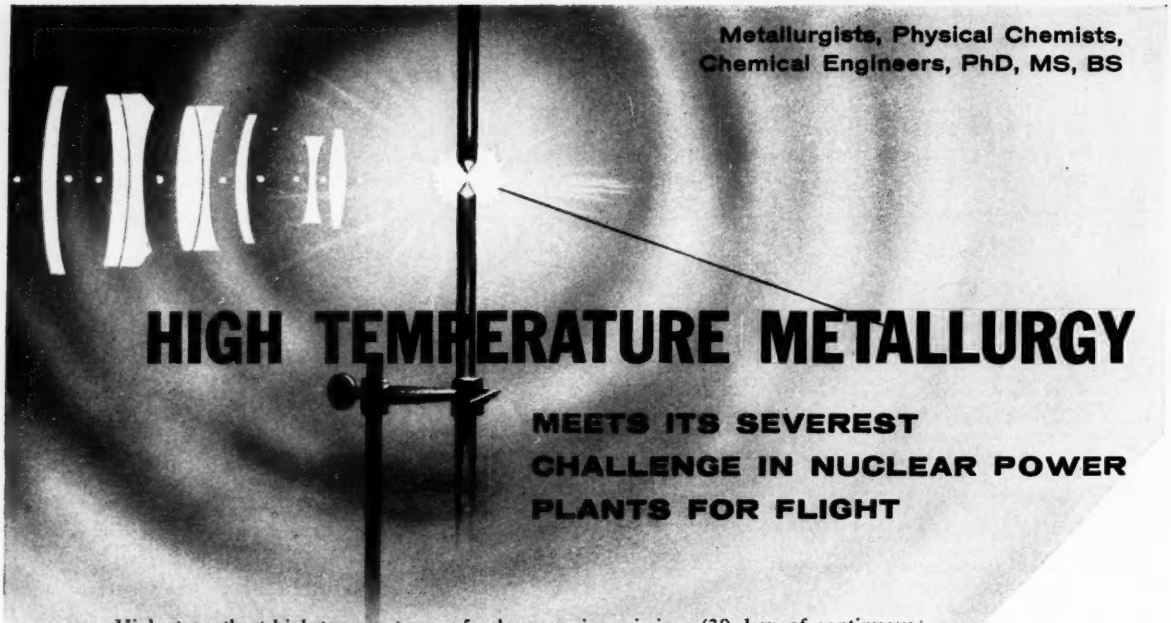
Midwest

METALLURGICAL SALES ENGINEERS: Full or part time. Expanding corporation requires experienced salesmen in heat treating, plating, cleaning and melting equipment. Unlimited future. Openings in most major cities. Please send resume, territory covered and salary requirements to: Metal Treating Equipment Exchange, Inc., Richard J. Hertz, President, 9825 Greeley, Detroit 11, Mich.

METALLURGIST: Young graduate in metallurgy with several years experience, preferably in quality control, to work on process and quality control in large plant manufacturing carbon, alloy and stainless steel tubular products. Excellent opportunity to develop with a progressive company. Box 4-20.

FERROUS PROCESS AND PHYSICAL METALLURGISTS: With one to five years experience in the iron and steel industry, to work with expanding research and development organization in large and extremely diversified steel producing facility. Openings available for metallurgical engineers familiar with and having working knowledge of blast furnace, sintering plant, various steel producing processes, rolling mills and product physical metallurgy. B.S. degree required. If you desire a challenging assignment with opportunity for professional growth and advancement, send complete resume. Box 4-25.

METALLURGIST: Or equivalent training. Degree, age to 30, with one to five years experience in steel mill, technical sales or ferrous heat treating and fabricating. Excellent opportunity for growth, advancement in areas of technical sales, sales, management or plant operations. Prominent specialty steel processor, multiple plants. Send resume, experience, residence and telephone. Box 4-30.



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CARRY ON investigations of reactions in the solid state for Materials Testing Laboratories. PhD, Physical Chemistry.

PARTICIPATE in research on advanced moderator materials. Investigations in field of ionic, covalent and metallic bonding; hydrogen stability in metals at elevated temperatures; kinetics of advanced moderator systems. MS.

PERFORM laboratory investigations in metallurgical melting, casting, fabricating and forming processes. Also phase studies; solid solution alloy studies. MS preferred.

DIRECT studies on materials used in moderator materials development. PhD.

PROGRAM and evaluate specific tests on fuel element materials and assemblies. Compile and publish data. MS, BS, 5-7 years R&D experience.

CONDUCT project technical liaison on materials selection and processing. Develop design data on materials. BS, 5-7 years experience with high temperature alloys.

CARRY OUT liaison with materials subcontractors. BS with 7-9 years experience in development or sales engineering.

ASSIST in development of instrumentation for measuring high temperatures and other instrumentation. MS, BS, 1-3 years experience.

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RESEARCH — ELECTROPLATING: Science or engineering graduate, minimum B.S. degree, to do electroplating research in modern laboratory located surburban Pittsburgh. Experience desirable but not necessary. Salary commensurate with training and experience. Box 4-160.

West

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METALLURGIST: For refractory materials research laboratory. Minimum requirement B.S. degree. Experience in high-temperature materials, particularly in powder metallurgy, and knowledge of exotic materials and their applications desired. Submit resume and salary requirements to: Personnel Manager, Narmco Industries, Inc., 8125 Aero Drive, San Diego 11, Calif.

FOUNDRY METALLURGY: For leading investment casting house. Two years minimum foundry experience necessary. Should have working knowledge of both ferrous and nonferrous melting. Heat treating experience desirable. Box 4-40.

Foreign

IRON CASTINGS CONSULTANT: Italian company seeks experienced American specialist in radiator castings for modern central heating systems as consultant for six months. Applicant would have to transfer to Italy for that period. Write, with resume, to: Finmeccanica Delegation, 11 W. 42nd St., New York 36, N. Y.

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Box 4-155, Metals Review

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Box 4-170, Metals Review

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PhD

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BOX 4-150, METALS REVIEW

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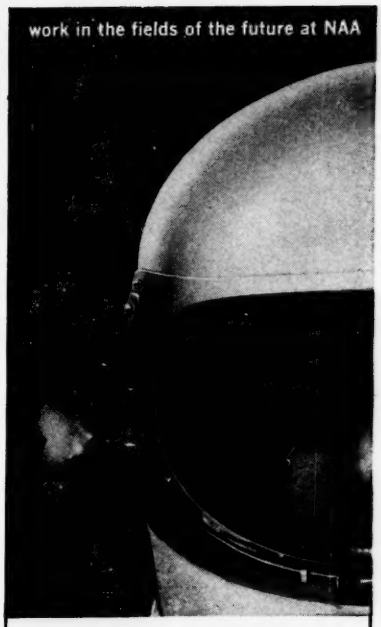

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RESEARCH METALLURGISTS

The J&L Research Division wishes to add to its staff in 1959 several professional metallurgists, to broaden the scope of the Corporation's research programs in carbon and stainless steels.

Of specific interest are physical metallurgists (Ph.D., or M.S. with related research experience) to conduct projects in high-temperature materials, alloy development, corrosion, general applied physical and mechanical metallurgy.

Several openings exist also for recent B.S. graduates, in the fields described above and in projects dealing with steelmaking process analysis and development. For the B.S. graduate interested in a permanent research career, Pittsburgh offers unmatched opportunity for continued education at the graduate level.

J&L is fourth-largest in the United States steel industry, making a wide variety of carbon and stainless steel products. The Research Division is located in modern facilities in suburban Pittsburgh.

J&L STEEL

Send resume, in confidence, to John A. Hill
Research and Development Department
Jones & Laughlin Steel Corporation
3 Gateway Center, Pittsburgh 30, Penna.

POSITION WANTED

SUPERVISOR, CONSULTANT, SALES OR SERVICE: Man with over 35 years experience in diversified heat treating in automotive, diesel engine and aircraft parts, tool and die hardening. Box 4-45.

METALLURGICAL ENGINEER: B.S. degree plus advanced studies, age 37, family. Seven years experience in commercial laboratories with emphasis on ferrous metallography and customer investigations. Some X-ray diffraction and radiography. Practical experience in setting up and operating metallographic laboratory. Activity being discontinued by present employer. Resume on request. Will relocate. Minimum salary $7200. Box 4-50.

HEAT TREAT SUPERVISOR: Age 40, B.S. and M.S. degrees. Extensive background in all phases of steel and aluminum heat treatment as well as electroplating, welding and brazing. Experience well balanced in technical, production and administrative phases. Desires responsible charge of heat treating and/or electroplating operation in Midwest. Box 4-55.

MECHANICAL METALLURGIST: With 20 years experience in practical plant metallurgy including specification writing and inspection of materials and plant problems. General plant experience in machining, fabricating, heat treatment, selection of materials, corrosion, brazing and design. Experienced in carbon and alloy steels, stainless and nonferrous. Will relocate. Box 4-60.

METALLURGICAL ENGINEER: Three years diversified experience in research and development including powder metallurgy, magnetic materials and vacuum melting. Seeks position in research or development. Immediately available. Resume on request. Box 4-65.

METALLURGICAL ENGINEER: B.Met.E. degree, age 32, family. Registered engineer. Six years experience as metallurgist and materials engineer in aircraft control field. Concerned with materials selection, processes, specifications, etc. Employed past year as metallurgist by state highway department. Desires responsible position utilizing experience and offering advancement on merit. Box 4-70.

ANALYTICAL CHEMIST: Ten years experience, B.S. degree, married, two children, veteran. Familiar with X-ray diffraction and fluorescence, spectrograph, control of metal processing and plating solution tanks, high-vacuum gas analysis of metals and wet chemical techniques. Box 4-75.

PATENT ATTORNEY TRAINEE: B.S. in Met.E., LL.B. in law, age 28, member of state bar. Graduate courses in patent law. Seven years of research, development and production experience in metallurgy and electrochemistry. Desires position with corporate patent department or law firm. Box 4-80.

METALLURGIST: Nineteen years experience in metallurgical laboratory, commercial heat treating, automotive forging and manufacturing heat treating, and jet engine heat treating as supervisor. Desires responsible position where advancement is possible and past experience beneficial. Thirty-eight years old, married. Will relocate. Box 4-85.

TECHNICAL RESEARCH DIRECTOR: Initiated and managed basic and applied research and development projects for both private and government agencies. Excellent record of performance in scientific achievements (physical metallurgy), material development for high-temperature, nuclear and magnetic applications; product planning and process development leading towards pilot plant operations and production. Seeks challenging position, will relocate. Box 4-90.

MASS SPECTROMETRY: B.S. degree in geophysics—geochemistry, June 1959. Age 27, veteran, family. Laboratory experience in metallurgy, nuclear geology and electronics. Prefers employment along these lines. Interested in laboratory or plant work. Would like to settle new university facilities. Box 4-95.

METALLURGICAL ENGINEER: B.S. degree I.I.T., 1940, 18 years experience. Desires management or supervisory position in technical or service department of midwest manufacturing company. Broad experience in applications and uses of both ferrous and nonferrous materials, and processing. Will provide genuine technical leadership, planning and organization. Resume on request. Box 4-100.

METALLURGIST-CHEMIST: Age 36, married, 18 years diversified experience in metallurgical laboratory of knitting machine and wire products companies. Directory of laboratory, performing metallography, physical testing and chemical analysis. Desires position with manufacturing concern where engineering degree is not essential for advancement. Technical school background. Box 4-105.

METALLURGIST: M.S. degree, age 43. Five years with steel company research laboratory in physical metallurgy of ferrous alloys including properties, heat treatment, metallography and mechanical testing. Evaluation, development, selection, application and failure analysis of materials and processes on production and advanced experimental engines. Supervision, design consultation and project engineering. Responsible position in development desired. East preferred. Box. 4-110.

METALLURGICAL ENGINEER: Degree in metallurgy, 39 years old, 18 years diversified experience embracing engineering, mechanical testing, physical metallurgy, material application, etc. Thoroughly familiar with wrought and cast ferrous and nonferrous metals, including materials of construction for electronic tubes, radar and special applications. Presently employed in supervisory position on East Coast. Desires responsible position offering growth with major firm, West Coast or Denver, Colo., areas preferred, but will consider other areas. Present salary $14,500. Box 4-115.

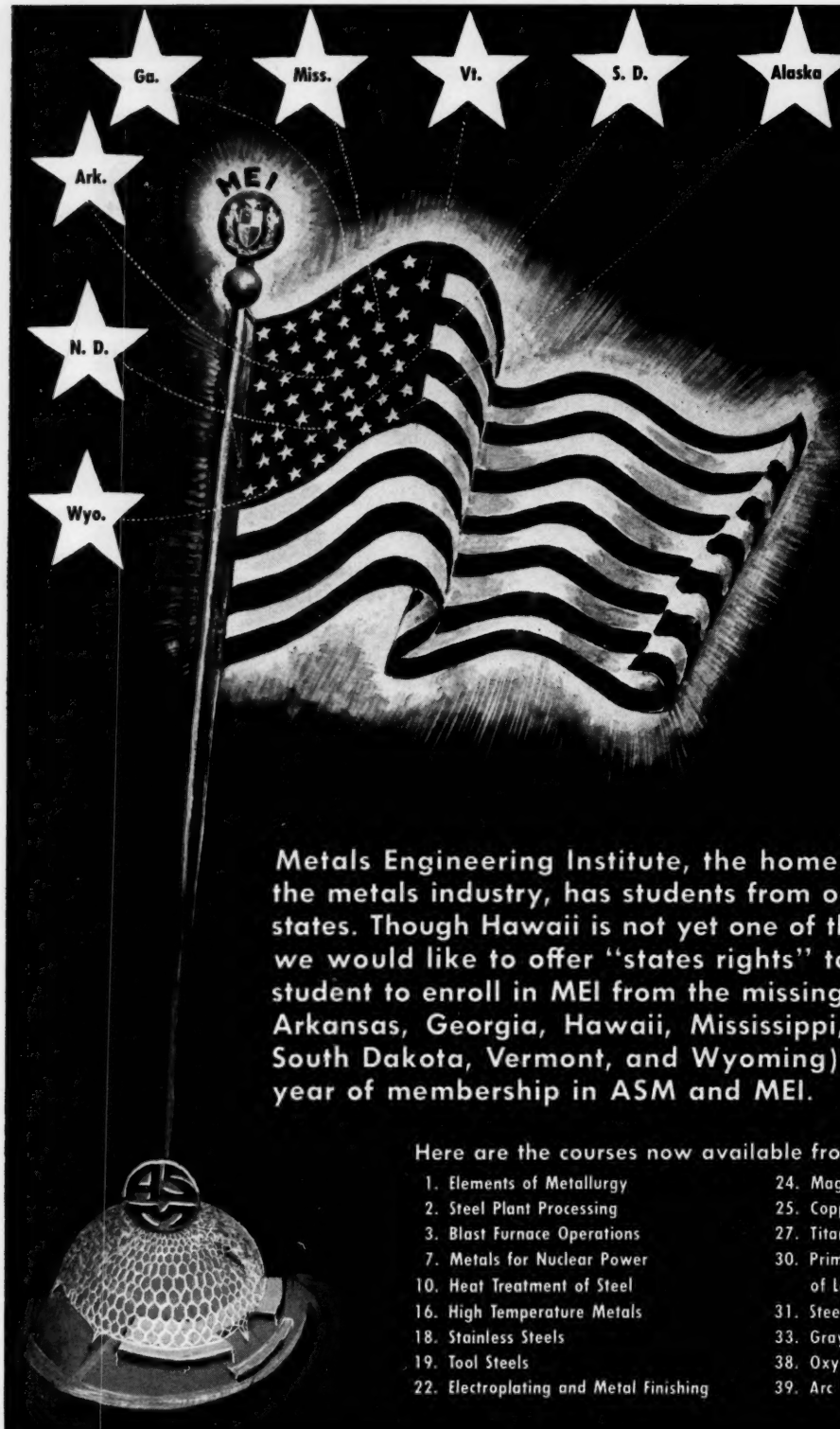
CHEMIST: B.S. degree, age 31, married, veteran. Seven years experience in research and development in ferrous and nonferrous metallurgy, including vacuum technology, kinetic studies in gas-metal systems, micro-gas analysis (vacuum fusion) of metals. Publications. Desires research and development or non-routine analytical field. Box 4-125.

WELDING ENGINEER: Graduate, age 34. Past eight years spent in aircraft in welding process development, welded materials research, process control and welded structures development; participated in development of two types of sandwich brazing. Considerable experience with welding of hot work steels. Desires responsible position with aircraft company, Midwest or West Coast. Box 4-130.

METALLURGICAL ENGINEER: B.S., University of Illinois, to receive M.S. in industrial management, Purdue, August 1959. Interested in work in marketing—product development, analysis and promotion—or sales, with limited travel. Experience includes 20 months engineering and sales work. Age 26, married. Box 4-135.

METALLURGIST: B.S. in Met.E., 1947, age 37. Experience in heat treating, tool and die hardening, ore dressing and smelting, plant engineering, reports. Especially interested in technical service and application of metals and metallurgical equipment; marketing; production. Will undertake and learn new field of experience such as vacuum metallurgy, corrosion, powders, metallurgical economics, etc. Box 4-140.

METALLURGICAL ENGINEER: Ph.D. degree, six years experience in research and development of high-temperature alloy steels and two years in electron tube technology. Age 38. Seven technical papers. Licensed professional engineer. Desires managerial position in the research and development of refractory metals and alloys. Box 4-145.



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KAPL Physicist Rudolf E. Slovacek working with Laboratory Developed Time of Flight Analyzer. The graphs he is holding show neutron spectra curves obtained from data provided by the new Analyzer. This compact instrument fits into one 10-inch chassis.

MILESTONES IN REACTOR TECHNOLOGY

at The Knolls Atomic Power Laboratory...in Spectra Physics

THE FIRST ALL-TRANSISTORIZED Time-of-Flight Analyzer has been developed at KAPL to aid scientists in determining neutron energy distributions in a reactor core.

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Advances such as the Time-of-Flight Analyzer are consistently being made at KAPL, in every technology related to pioneering work in nuclear propulsion for marine applications. Hundreds of KAPL scientists and engineers like Rudy Slovacek are contributing new research findings and techniques in Reactor Physics, Metallurgy, Ceramics, Mechanical Design, and other fields. Projects benefiting from such milestones include KAPL's twin Pressurized-Water Reactors for the Submarine *Triton* and a power plant for the world's first atomic powered destroyer.

PROFESSIONAL OPPORTUNITIES

...exist today for talented physicists, engineers and metallurgists who are interested in contributing to this development. U.S. citizenship required; advanced degree or related experience preferred. Send complete resume and salary requirement to: Mr. A. J. Scipione, Dept. 41-MD.

Rudolf E. Slovacek is one of a number of KAPL scientists concerned with reactor physics. He earned a BSEE at Union College in 1945, joined KAPL in 1951 after taking his MS in Physics at Indiana University. Since then he has contributed to several KAPL projects.

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